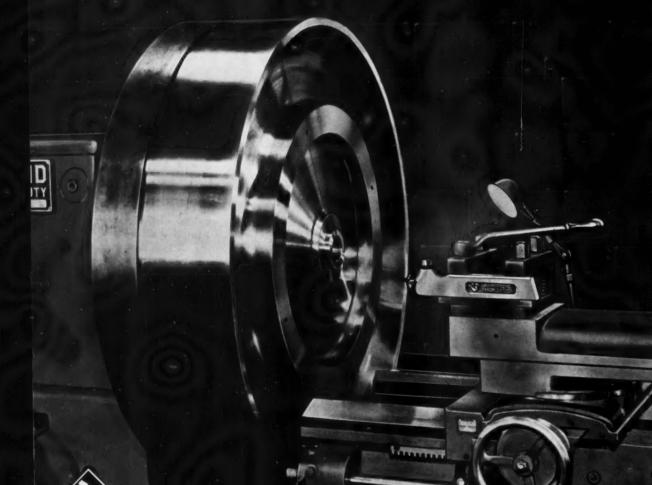
ENGINEERING AND PRODUCTION IN METALWORKING

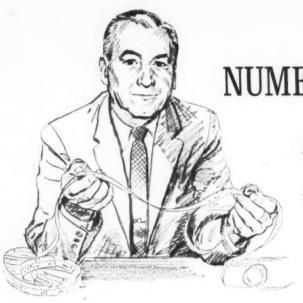
JANUARY, 1961

Machinery



ARMSTRONG TOOL HOLDERS

Any lathe, large or small, will operate at top cutting efficiency when you use ARMSTRONG Tool Holders. See advertisement page 32.



NUMERICAL CONTROL...

A Realistic Appraisal

by A. Francis Townsend Vice President, Engineering The Heald Machine Company

At the 1960 Machine Tool Exposition, numerical control emerged as the shining new star on the metalworking horizon. In fact, if you didn't have something numerically controlled to demonstrate, you just weren't in the running.

This subject is one that deserves a realistic appraisal. Is it a "fad" that will not stand the test of time? Or is it a panacea, a cure-all, that will eventually make all manually-operated machines obsolete?

Since Heald offers both numerically controlled and manually operated machines, we can afford to look at the subject objectively. Of this we can be sure—numerical control is here to *stay*. On the other hand, we can be equally sure that it is not the universal solution to all machining problems—and that manual operation will also be around for a long time to come.

Where to use numerical control is largely a matter of production economics. How far it can be *profitably applied* depends on many factors, including the nature of the workpiece and the operations to be performed. In general, however, numerical control will usually be most advantageous where any of the following conditions are encountered.

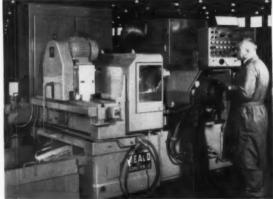
- Where several different setups are required on the same or different workpieces.
- 2. Where the operations performed are complex in nature.

Numerically-controlled HEALDRILL makes high-precision layout or production drilling fully automatic —with tape control of precise hole location as well as selection of speeds, feed rates and tool change indication. A taped program for any workpiece can be stored and reused whenever needed for exact duplication of the most complex drilling operations.



- 3. Where manual setup time is relatively high.
- Where time for tooling design, manufacture and use must be reduced.
- Where variety and complexity of work require excessive tooling cost.

Properly applied, numerical control offers many profitable opportunities for making substantial cost reductions. Improperly applied, it will be a disappointing investment.



Numerically-controlled Bore-Matics permit contour boring and turning of irregular shapes with higher accuracy and precision than were here-tofore obtainable. In routine production, the machine shown here contour turns an aluminum workpiece to ± .0001" of true path.

Your Heald engineer is fully qualified to help you evaluate the economics of numerical control for Borizing, grinding and precision drilling operations. It will pay you to call him in before taking the "plunge."



Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts

JANUARY 1961 VOL. 67 No. 5

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Machinery

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

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ADVERTISERS' INDEX

most threading jobs should be **ENGINEERED**

More and more people are realizing the great advantages in production, time saved and increased profits from running a threading operation that is properly engineered.

For instance, Landis engineers recently obtained the utmost in threading efficiency by advising the replacement of a machine of another make with a LAN-NU-ROL Thread Rolling Machine in threading job lots of 1 to 1000 studs at the General Electric Plant in Lynchburg, Va. Besides improving thread quality, all sizes and diameters were rolled on the LAN-NU-ROL. The exclusion of several operations and equipment plus eliminating the need for purchasing certain sizes of pre-threaded bar stock were important cost-saving advantages.

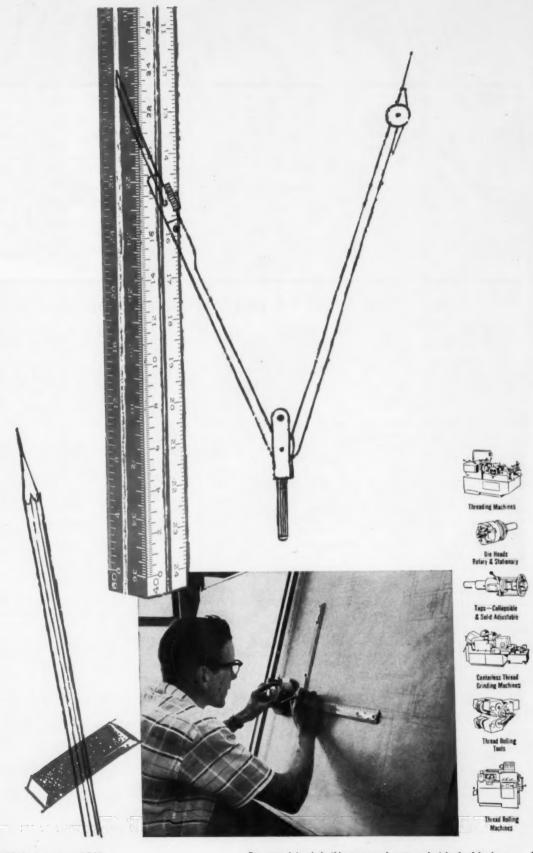
But this is only one of the many hundreds of threading operations throughout the country benefiting from the results of Landis engineering. Advice on thread design, the proper threading method to use, the proper threading equipment to use, and the development of special tooling, fixtures, or equipment for unusual operations are among the services offered.

Won't you take advantage of our Engineering Services? Whether the method of thread generation is Cutting, Rolling, Tapping or Grinding Landis engineers are ready to assist you.

LANDIS Machine Company

WAYNESBORO • PENNSYLVANIA
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

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592C

how's this for high-speed hobbing?

	WORK PIECE				HOB (1 start)		HOB (1 start)						
Dia. Pitch	No. of Teeth	Helix Angle	Face Width	Material	Dia.	RPM	Feet PM	Feed	Pieces per Load	Method*	Time per Piece	Pieces per Grind	Cut
10	20	15°	13/4"	1040 leaded	3"	500	395	.055"	1	A	2 min. 25 sec.	150	Finish
7	23	13°	3/4"	8620	4"	350	370	.100"	2	A and B	59 sec.	240	Pre- shave
5	43	24°	15%"	8620	4"	280	300	.100"	2	В	3 min. 45 sec.	80	Pre-

^{*} Method A: Diagonal Hobbing. Method B: Step-by-step Hobbing.

This is the kind of performance you get with THE FELLOWS-PFAUTER P400 HIGH-SPEED HOBBING MACHINE

HIGH-SPEED HOBBING. Performance speaks louder than words. The examples given above show the results of high-speed hobbing which can cut costs. The figures are taken from the records of typical production runs on the Fellows-Pfauter P400.

DESIGN. The P400 was designed for High-Speed Hobbing, and it features a new basic design. The individual machine elements are of maximum rigidity. The hob head is heavy and rugged, the machine column and bed are of double-wall construction with heavy V-ways and the work table is as large as the maximum permissible work piece diameter. The index worm gear is nearly as large as the work table, and the work support column is of massive construction. All parts of the machine are properly proportioned and of sturdy design to eliminate vibration. The cost is more than justified by the resulting reductions in hobbing times and the increased hob life.

RIGIDITY and CLOSE TOLERANCES. The large size work table and index worm gear and the oversize

and index worm gear and the oversize hob head, which eliminates lead errors caused by hob breakout, are important factors in providing the rigidity necessary to hold work to close tolerances.

COMPLETELY OPEN WORKING AREA. The machine and the work-support columns are of such rigid construction that the hobbing stresses are absorbed without requiring an over-arm. Therefore the working area is easily accessible for set-up and work loading. The automatic retraction of the table from the hob also facilitates changing of work.

SET-UP TIMES and FLOOR-TO-FLOOR TIMES are reduced on the P400 because it has infinitely variable speeds and feeds, rapid traverses for all machine movements, including hob shifting manually by push button, and built-in hydraulics for the operation of the tailstock and simple hydraulic fixtures used on this machine.

AUTOMATION on the P400 is simple and fast. The illustrations show a machine equipped with automatic loading and unloading devices.

GEAR HOBBING COSTS can be cut by high-speed hobbing on a P400 because of the resulting savings in production time, floor space, maintenance and labor.

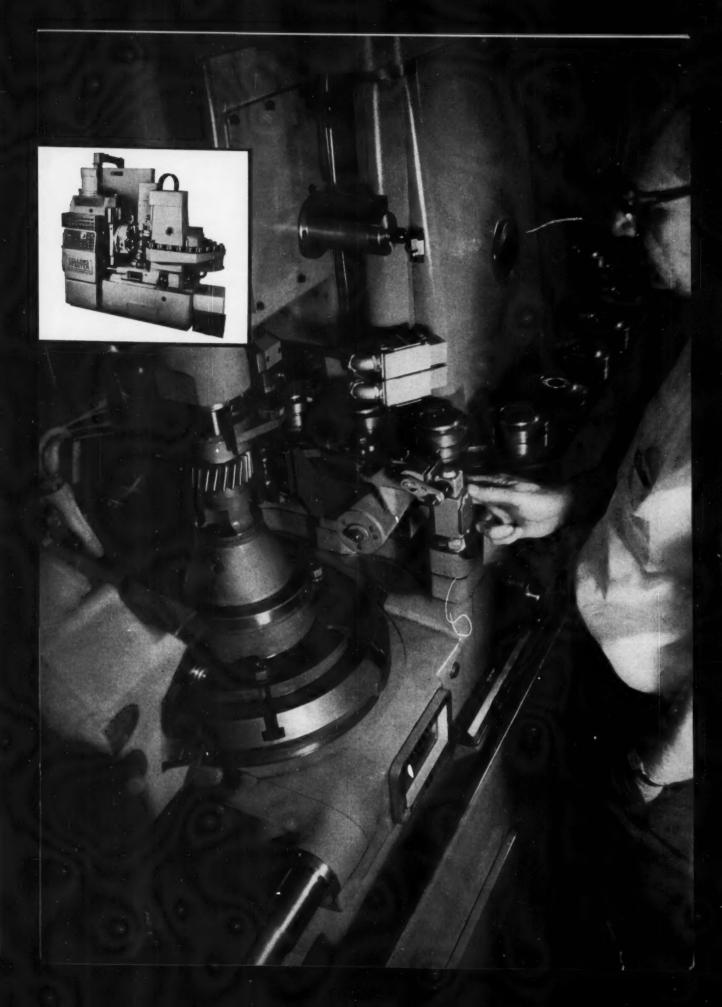
THE FELLOWS GEAR SHAPER COMPANY 78 River Street, Springfield, Vermont, U.S.A.

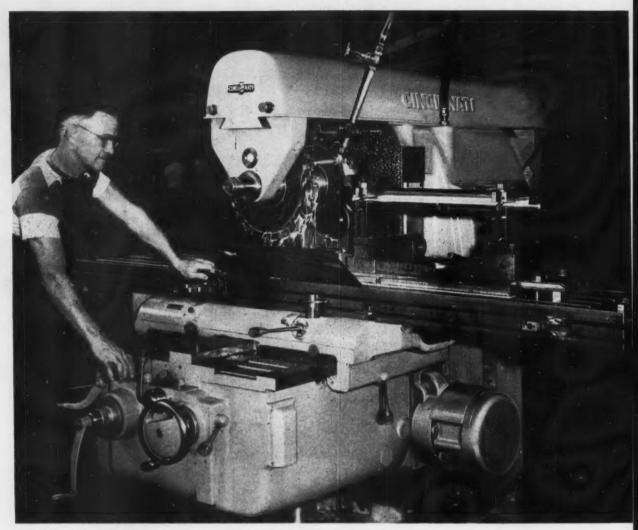
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Gear Production Equipment

THE PRECISION LINE







Extra large working range of the BIG DIAL TYPES is evident from the gang of cutters required for this straddle milling operation.



Power feed and speed changes in increasing or decreasing order with one lever. An exclusive Cincinnati advantage.

CINCINNATI HIGH POWER AND DUAL POWER DIAL TYPE MILLING MACHINES

HIGH POWER DIAL TYPE		SPINDLE DRIVE MOTOR, HP	SPINDLE SPEEDS	FEEDS
215-16, 315-16	plain, universal, vertical	15	16-1600 rpm	%-90 ipm
320-18, 420-18	plain, universal, vertical	20	16-1600 rpm	3/4-90 ipm
425-20, 525-20	plain, universal, vertical	25	14-1400 rpm	%-90 ipm
625-20	plain and vertical	25	14-1400 rpm	%-90 ipm
DUAL POWER DIAL TYPE				
220-16, 320-16	plain, universal, vertical	20	16-1600 rpm	%-90 ipn
330-18, 430-18	plain, universal, vertical	30	16-1600 rpm	%-90 ipn
450-20, 550-20	plain, universal, vertical	50	14-1400 rpm	36-90 ips
650-20	plain and vertical	50	14-1400 rpm	3/4-90 ipn

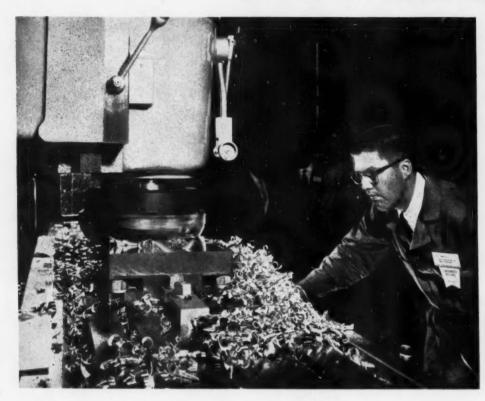
Catalog No. M-2134



BUILDERS OF FINE MACHINE TOOLS: KNEE TYPE AND BED TYPE MILLING MACHINES . DIE SINKING MACHINES . THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

THE BIG DIAL TYPES

QUICKLY CUT METAL AND COSTS



Heavy cutting capacity of a CINCINNATI Verical Dual Power Dial Type Milling Machine is demonstrated in this setup. The complete Cincinnati line includes 40 size, style and power ratings.

It's a revelation to see Cincinnati Milling's big High Power and Dual Power Dial Types . . . how easily they can be handled . . . how quickly they cut metal and costs. The following facts tell some of the reasons why:

- Extra large working surface and range-50" and 60" traverse for the 5 and 6 series respectively; smaller series in proportion
- Powerful drive-50 hp motor for larger sizes
- Single lever control of table feed and rapid traverse (plain and vertical machines)
- Four-position turret stop and vertical feed to head of vertical machines

- Hydraulic spindle starting, front and rear working positions
- Flywheel mounted on spindle a feature-advantage for high speed carbide milling

These and other advantages give the CINCINNATI High Power and Dual Power line the highest value for replacing old knee type milling machines now inadequate for heavy duty toolroom and production milling. Brief specs are tabulated at left, and complete details are contained in catalog No. M-2134. Write today for your copy, or telephone Cincinnati REdwood 1-2121.

CUTTER AND TOOL GRINDERS . ELECTRICAL MACHINING EQUIPMENT



NOW...a completely automatic

LANDIS

LANDIS





automatic indexing 'on the fly'



automatic locating for side wall grind



automatic rotary diamond wheel dressing

automatic Microfeed®

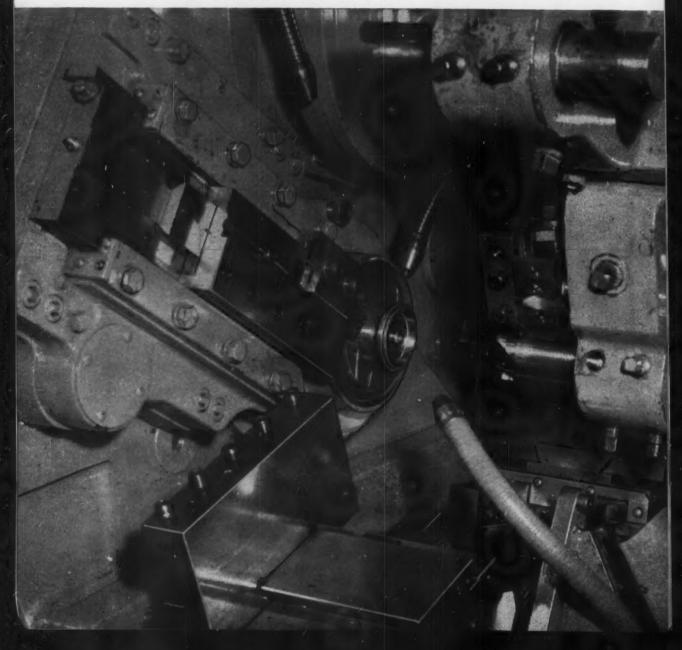
world leader in precision grinders

LANDIS TOOL COMPANY, WAYNESBORO, PA

Dearborn Manufacturing Co.,
Detroit, Michigan, manufacturers of precision parts
and products, uses a 3-inch capacity Warner & Swasey 2AB
Single Spindle Bar Automatic
for small lot precision blanking
of stainless steel parts used in
aircraft and missile navigational
equipment. Production
up two to three times

over former methods.

AIRCRAFT
Canche can purple anking ased in ational AUTOMATIC



Three major factors led DEARBORN MFG. Co. to select the Warner & Swasey 2AB Single Spindle Automatic Bar Machine:

- 1. To be able to produce precision blanks with minimum stock allowance for secondary operations. Precision in this case means tolerances to .001 on diameters; .002 on lengths; concentricities to .001 T.I.R. Blanking to these close tolerances reduces the number of secondary chuckings required and eliminates heat distortion problems which occur when excess stock is removed rapidly in finishing operations.
- Dearborn's major customers also use modern Warner & Swasey 2AB's and 2AC's. When subcontracting, their tools are sent to Dearborn where tooling interchangeability assures identical quality and maintenance of production schedules.
- The 2AB Bar Automatic can be quickly and easily converted to chucking work thus providing greater flexibility to meet customers' production schedules.

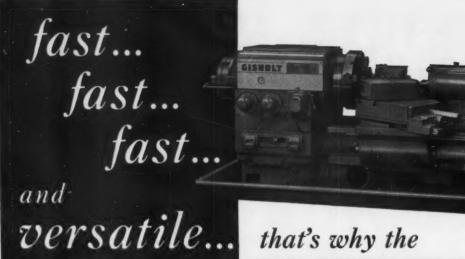
The 2AB easily holds total tolerances of .001 with single point tooling. On many jobs secondary precision boring and centerless grinding operations have been eliminated. Warner & Swasey's exclusive camless design enables Dearborn to make frequent setups quickly, and obtain automatic production rates on lot sizes as few as 100 pieces.

Installed at Dearborn "back to back" with a Warner & Swasey 2AC Automatic Chucker, one operator usually handles both machines, thus splitting the direct labor costs. Tool interchangeability between the bar and chucking machines keeps inventory of standard tools down. And because of their unusual versatility, special tool costs are also minimized.

Why not call in your Warner & Swasey Field Engineer for more facts on how the 2AB can help you handle a wider range of jobs—short, medium or long run—at a better profit to you. Warner & Swasey Co., Cleveland 3, Ohio.



WARNER & SWASEY





This setup cut O.D. machining time 27% on diesel cylinder liners. Basic design of No. 24 offers flexibility and power to handle multiple surfaces on large parts. Nineteen tools machine 16 surfaces in only 6 minutes f.t.f.



Time was reduced 30% on 60 part sizes with this setup. Front and rear independent slides are placed to suit the work. Optional swivel bases speed angular settings. F.t.f. time on the 15¾" steel outer bearing race shown, only 3 minutes.



Single- or multiple-pass JETracers on the rear independent slide increase versatility. Here a single-pass JETracer handles six types and 24 sizes of steel bearing races. Two 8-minute operations complete part shown, removing 90-lb. metal, holding .0005" tolerance in spherical bore.

GISHOLT No. 24

Automatic Chucker

cuts costs four ways

When you bring the speed and the versatility of the Gisholt MASTERLINE No. 24 into your shop, here's what happens:

- You profit from high-speed, automatic production on a wide range of work, from small lots to long runs.
- You get the production of an expert from an inexperienced operator. Automatic cycle gives you repeat accuracy and optimum tool life at fixed production rates.
- You reduce labor requirements—one operator handles two
 or more machines.
- 4. You get the speed, the power, the rigidity to take full advantage of today's most advanced cutting tools for maximum metal removal and finer finishes.

The jobs at the left are just a small sample of what you can do on the fast, versatile Gisholt MASTERLINE No. 24 Automatic Chucking Lathe. What can it do...how much can it save on your work? Find out. Call your Gisholt Representative or write for Bulletin 1213.



Madison 10, Wisconsin

Investigate Gisholt's Extended Payment and Leasing Plans

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes
• Factory-Rebuilt Machines with New-Machine Guarantee

tolerances to .0005" 1250 PARTS PER HOUR

Gardner disc grinder delivers high output and precision in automotive parts production



High production of clutch races results from combination of Gardner grinder and automatic work handling.



	37
	production part: rate:
GARDNER	stock remo flatness: . parallelism uniformity
E T SIL	Send us y production

 production data
 clutch races

 part:
 1250 parts per hour

 stock removal:
 .015"—.023"

 flatness:
 .0005"

 parallelism:
 .0005"

 uniformity:
 .002"

Send us your prints for a practical solution to your production problem.

GARDNER

precision disc grinders

BELOIT, WISCONSIN



VERSON HYDRAULIC PRESS lowers cost for John Wood Company

The Hot Water Heater and Tank Division of the John Wood Company, Chicago, Illinois, employs a Verson Hydraulic Press with Hydrol Speed Circuit to produce hot water tank heads from 12" to 24" diameters.

The 350 ton press operates at a fast advance speed of 1125 inches per minute, slows to a pressing speed of 81 inches per minute and has a fast return of 458 inches per minute. Using pre-blanked stock from 11 gauge to ½" steel, the press draws the metal to desired shape quicker, and more efficiently than was possible with two presses previously used.

The plant's usable floor space is increased and at the same time labor cost of this operation has been cut in half.

Whatever your requirements, you'll find that Verson can provide the press you need to make your operations more efficient. As a big plus, you get all the advantages of Verson know-how and experience in the press working of metals. It can make a big difference in your profits. It's easy to put the Verson team to work for you. Just contact your Verson Representative. For data on the entire Verson line, write for Catalog G-60.



Originators and pioneers of allsteel stamping press construction

VERSON ALLSTEEL PRESS CO.

9309 S. Kenwood Avenue, Chicago 19, Illinois • 8300 S. Central Expressway, Dallas, Texas

MANUFACTURERS OF MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES

TRANSMAT PRESSES . IMPACT MACHINING PRESSES . TOOLING . DIE CUSHIONS . VERSON-WHEELON HYDRAULIC PRESSES . HYDRAULIC SHEARS

THREAD GRINDING COSTS TOO HIGH?

Here's How a Modern Ex-Cell-O can Increase Production and Lower Your Labor Costs

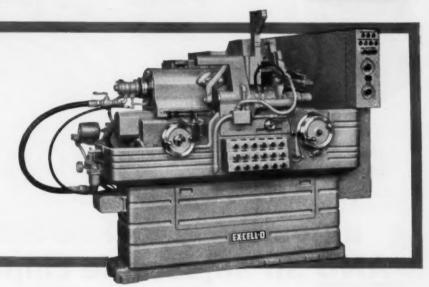


1939—Style 39 Ex-Cell-O Internal Thread Grinder, then the fastest of its kind, produced 17 automotive steering gear ball races per hour. It had power wheel dresser, automatic dresser compensation and automatic wheel feed.

1946—The part's the same, but the manufacturer has turned to a postwar Ex-Cell-O Style 39-A Precision Thread Grinder with fully automatic grinding cycle, including automatic wheel dressing at predetermined intervals. Operator simply loaded the part, reset the size handwheel and pressed the start button. Production increased to 24 parts per hour.



1960—Modern Style 39-A, today produces the same basic part but now at a rate of nearly 60 parts per hour. This powerful, versatile machine has a high-speed workhead, high-frequency Bryant Grinding Spindle, automatic loading, unloading and cycling. It requires only the part-time attention of one unskilled operator.



TOMORROW—Will you have a similar long-run part, or perhaps pinions, worms, taps, thread gages, lead screws, missile components or other special parts that cannot be rough- or finish-ground economically on your present equipment?

Your local Ex-Cell-O Representative can show

you how modern Ex-Cell-O Precision Thread Grinders can substantially reduce the cost of producing a wide variety of your large and small threaded parts. Call him today, or write direct for details on the complete line of Ex-Cell-O Internal, External and Universal Thread Grinders for every toolroom and production job.

60-35

EX-CELL-O FOR PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS - GRINDING AND BORING SPINOLES - CUTTING TOOLS - DRILL JIG BUSHINGS - TORQUE ACTUATORS - CONTOUR PROJECTORS - GABES AND GAGINE EQUIPMENT - GRANNET SUBFACE PLATES - AIRCRAFT AND MISCELLANCOUS PROPOSETION PARTS - ATOMIC ENERGY EQUIPMENT - RAILROAD PINS AND BUSHINGS - DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

RE TOOLS
(IS EQUIPA ATOMIC
UNIPMENT

DETROIT SE, MICHIGAN

NEW KENDEX* Profiling Tool



The only one with... a positively locked insert AND an adjustable chipbreaker

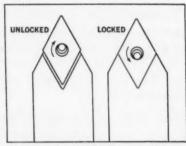
Now in one profiling tool you can get both of the latest design improvements. Another "first" from Kennametal Inc., the new Kendex Profiling Tool (A) securely holds inserts during normal cutting, back facing or contouring, and (B) permits a wide range of chipbreaker adjustment by simply turning a dial wheel.

The main design feature of this dramatically new Kendex tool is the eccentric pin that holds the insert securely in place. Positioned through a hole in the insert, this pin, plus the top clamp, positively eliminates any movement of the insert.

Just by turning the threaded dial wheel, the "Dial-A-Breaker" provides a wide range of adjustment of chipbreaker land width. Still another feature is the spring plunger that raises the chipbreaker when the clamp is released, making it easier to change, index or invert the insert.

Performance-proved on job after job over a period of months, the new Kendex Profiling Tool is now available from stock in three holder styles. The diamond shaped insert has a 55° nose angle, suitable for practically any profiling job. It is set in the holder at 5° negative side and back rake to provide four accurately indexable cutting points.

Get the complete story on this new profiling tool. Call your Kennametal Representative or write Kenna-METAL INC., Latrobe, Pennsylvania.



As the wrench is turned it first rotates the eccentric pin, forcing the insert back and locking it against two walls of the recess. Further rotation of the wrench locks the eccentric pin so that it cannot loosen during use.

*Trademark

3357



DO YOUR OPERATIONS DEMAND ACCURATE CENTERS?



Ex-Cell-O Center Lapping Machines Increase Accuracy, Reduce Scrap!

Precision Center Lapping Machines remove heat-treat scale, and eliminate roughness and distortion of centers to insure accuracy in subsequent operations.

Easy to use and modestly priced, Center Lapping Machines include as standard, inbuilt equipment Ex-Cell-O Precision Spindle and manual diamond dresser.

See your Ex-Cell-O Representative, or write for Bulletin 40271.

BEFORE LAPPING

- Out of line
- Out of round
- Incorrect angle
- Rough or torn



AFTER LAPPING



- Perfect alignment
- True roundness
- Precise angle
- Mirror-smooth

40.33

EX-CELL-O FOR PRECISION

EX-CELL-O PRESISION PRODUCTS INCLUDE: MACHINE TOOLS . GRINDING AND BORING SPINDLES - CUTTING TOOLS - RAILROAD PINS AND BUSHINGS - DRILL HE BUSHINGS - TORQUE ACTUATORS - GAGES AND GAGING EQUIPMENT - GRANITE SURFACE PLATES - ATOMIC ENERGY EQUIPMENT - AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS - DAIRY EQUIPMENT

Machinery Division

EX-GELL-0

RAUS

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CORPORATION

MENT

ME source for every press requirement

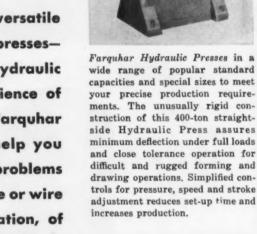


A complete line of mechanical presses for cutting, forming, drawing and embossing. This 60 ton O.B.I. Mechanical Press is typical of the modern design of Ferracute presses and incorporates the latest features in gap frame construction. Available from 32 ton to 200 ton capacities. Basic design meets J.I.C. standards. Air clutch and brake standard on presses of 100 tons and up - optional on other sizes.



PRESSES

This broad and versatile line of modern pressesmechanical and hydraulic -plus the experience of our Ferracute - Farquhar engineers will help you turn your press problems into profits. Phone or wire today - no obligation, of Dept. B course.



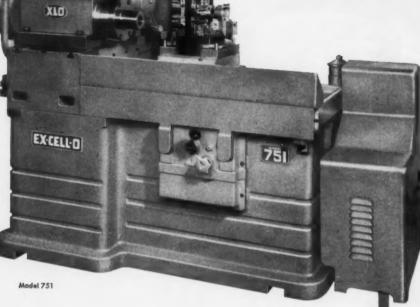


FERRACUTE MACHINE CO.

Mechanical and Hydraulic Presses and Special Machinery Since 1863 in Bridgeton, New Jersey, U.S.A.

EX-CELL-O ANNOUNCES...

NEW Horizontal Boring Machines

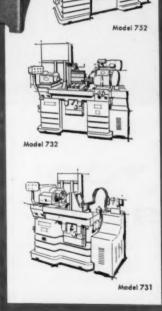


Designed and built for maximum dimensional stability under all operating conditions, these new hydraulically operated precision boring machines offer the ultimate in accurate repeatability.

Check these features for production efficiency . . .

- Temperature controlled hydraulic panels
- Extreme rigidity and stability in bases and tables
- . Hydraulic and coolant system externally mounted
- Ex-Cell-O standard and tapered roller bearing spindles
- Designed for close-tolerance precision boring, turning, facing, counterboring, chamfering, grooving, recessing and trepanning operations.
- May be operated either manually or automatically.
- Engineered for simple installation into automated production lines.

Contact your Ex-Cell-O Representative or write direct for details.



60-66

EX-CELL-O FOR PRECISION

Machinery Division

PRECISION MACHINE TOOLS - GRINDING AND BORING SPINDLES - CUTTING TOOLS - MAILEDAD PINS AND BUSHINGS - DBYLLIG BUSHINGS - TORQUE ACTEATORS - CONTOUR PROJECTORS - GARES AND GAGING EQUIPMENT - GRANITE SURFACE PLAYES - COMPUTER PRODUCTS - MAINCRAFT AND MISCELLANGOES PRODUCTION PARTS - ATOMIC CREEKY EQUIPMENT - DAIRY AND OTHER PACKAGING EQUIPMENT

EX-CELL-O



TOO SLOW

Emphatically not! . . . ask any visitor to the 1960 Machine Tool Exposition who watched a Marvel No. 6 Hack Saw Machine cut-off 3¼" diameter 1018 steel in 27 seconds! This Saw, costing less than \$3000, was actually cutting at the rate of 18 square inches per minute!

We made the above demonstration merely to "match" what we believe to be the impractical demonstrations of some of our competitors. OUR visitors were warned that continuous cutting at this speed is economically impractical if maximum blade life and accuracy (after the first 20 cuts) are desired. They were told that the material could be cut day in and day out, at the rate of 8 square inches per minute with tool cost of approximately 1 cent per cut.

Our point? Marvel No. 6 and No. 9 Series Heavy Duty Ball Bearing Hack Saw Machines, as we build them today, have <u>speed to spare</u>. And they offer the most accurate, economical cut-off at the lowest initial investment.

Ask your Marvel Dealer to arrange a sawing demonstration—on your own work—
if you wish. Because we have consistently built both Hack Saws and Band Saws
for more than 40 years, you will get an unbiased recommendation.

Catalog C60 illustrates and describes the complete line of Marvel Sawing Machines. Write for your copy.





BETTER MACHINES
BETTER BLADES

ARMSTRONG-BLUM MANUFACTURING CO. • 5700 Bloomingdale Avenue • Chicago 39, Illinois

LECTRA-FORM...The easy, low-cost way to cut hard and tough metals!



Lectra-Form produces an accurate, inverse image of the tool with a fine, uniform mattetype finish.



This wrench die was machined by Model 244 shown at right. Removable front panel of dielectric tank simplifies loading,



If the material you're working conducts electricity . . . you can drill, tap, pierce, trepan, slot or cut it, or sink intricate die cavities in it with LECTRA-FORM, the all-new Ex-Cell-O Vertical Electrospark Machine!

Using low-cost, conductive sheetmetal or tubing for tooling, LECTRA-FORM produces an inverse image of the tool, or electrode, through high-current, low-voltage electrical spark discharge. There is no tool pressure, no heat.

Standard Model 244 features include fourway slide positioning and vertical knee movement, automatic tool feed and gap distance control, front-load work tank, plus graduated dials for work positioning, a power supply cabinet and dielectric fluid storage tank.

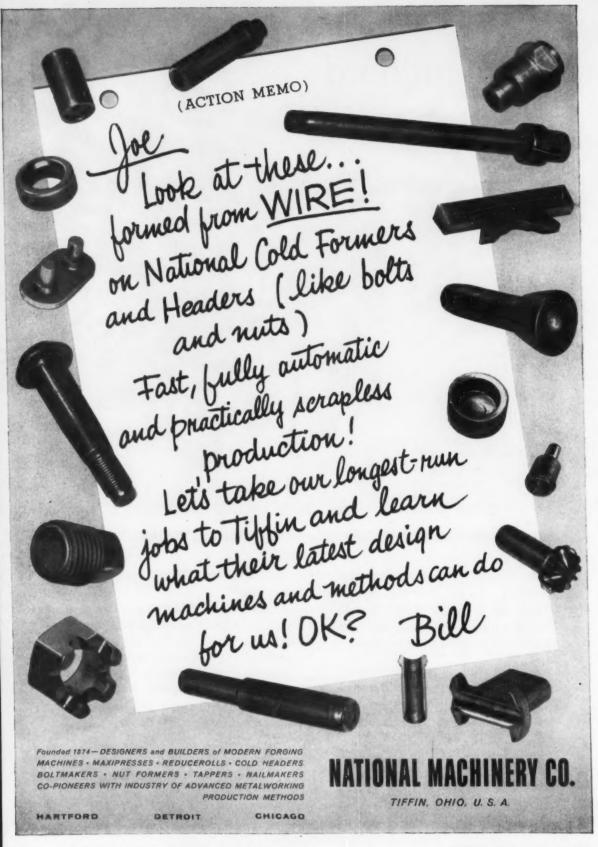
Contact your Ex-Cell-O Representative, or write direct for complete details.

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS - GRINDING AND BORING SPINDLES - CUTTING TOOLS - RAILROAD PINS AND BUSHINGS - DRILL JIG BUSHINGS - TORQUE AFTUATORS - CONTOUR PROJECTORS - GAGES AND GAGING EQUIPMENT - GRANITE SURFACE PLATES - COMPUTER PRODUCTS - ATRORAT AND MISCELLARIOUS PRODUCTION PARTS - ATOMIC EMERGY EQUIPMENT - DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-0

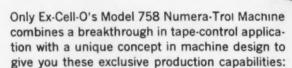


22

New Numera-Trol Automatically

Selects Bore Size and Location!



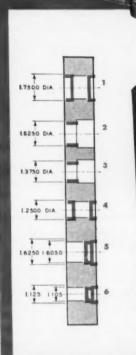


- Automatic pre-selected bore diameter control during machine cycle
- Automatic work positioning for infinite center locations
- Automatic straight-boring, step-boring and counterboring from either end of machine

Using interchangeable boring bars which respond to tape control through a new mechanism developed by Ex-Cell-O, the Model 758 Numera-Trol lets you program variable bore diameters. (Tools are available giving an infinite range of diameters in one-inch increments.) Bore diameters are controllable within .0005", bore depth is controllable to plus or minus .0005".

Infinite bore locations, accurate within .0002" of true center, are possible within the Model 758's 10-inch cross slide and vertical slide strokes.

Infinite, too, are the Model 758's applications. Your Ex-Cell-O Representative can give you complete details, or write direct for Bulletin 506015.





EX-CELL-D

On this workpiece, tapecontrolled sequence is programmed from largest to smallest diameters; automatic boring bar adjustment is made at the end of each stroke to eliminate drawback lines. Model 758 holds concentricity within very close tolerances.

60-8

EX-CELL-O FOR PRECISION

PAREISION MACHINE TOOLS - GRINDING AND SURING SPINOLES - CUTTING TOOLS - MAILROAD PINS AND
SUSTAINES - PRILL JIE BUSININGS - TORQUE ARTMATORS - CONTOR PROJECTORS - GAGES AND GARING
COLUMNIATY - GRANITE SURFACE PLATES - COMPUTER PRODUCTS - ATTERNAT AND MISCELLAREOUS
PRODUCTION PARTS - ATOMIC EMERGY EQUIPMENT - DAIRY AND OTHER PACKABING EQUIPMENT

Machinery Division

AND GAGING

AND GAGING

RELLANDERS

CORPORATION

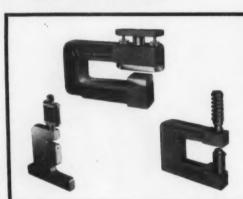
CORPORATION

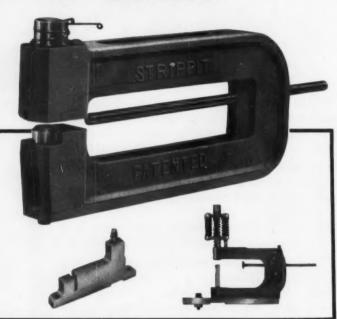
Wales STRIPPIT's new "BN" units have been designed for use with or without a guide button. Now, with this exclusive feature, only a punch and THE GUIDE BUTTON GOES OUT THE WINDOW



NEW STRIPPIT "BN" SERIES

is latest addition to the complete line of self-contained hole punching units





Only STRIPPIT's "BN" units offer all these features:

- Use of fitted or closed guide button optional.
- All holders keyed for both round or shaped punches and dies.
- Self-storing keys supplied with each holder.
- Streamlined holder permits punching closer to leg of formed flanges and angles.

24

- New die section design permits easy removal and rotation of die without removing holder from set-up and retains the advantages and strength of one-piece construction.
- New threaded gage rod positions work more accurately and positively.
- All units, including 3/4" unit, have hold-down slots for easier mounting.
- New stripping guide slips out quickly and easily without taking off retainer clip.
- One-piece oil hardened tool steel punches.
- Series expanded to include maximum hole size of 31/2" in 10 gauge material.

WALES

203 Buell Road

Akron, New York



In Canada: Strippit Tool & Machine Company, Brampton, Ontario

In Continental Europe: Raskin S. A., Lausanne, Switzerland In the British Isles: E. H. Jones (Machine Tools) Ltd., Hove, Sussex, England



DON'T FORGET TO TURN THIS PRESS OFF

(otherwise, we'll all be up to our ears in washing machines).

That's a man standing at right center of the photograph. He's not a little fellow either. The machine is 58 feet from left to right, but it's not remarkable for its size alone. It produces a small avalanche of washing machine covers every day. It does the job of a shop full of equipment because it performs all

operations automatically. Just push a button and stand back.

Want to push a button and zip up your production while clamping the lid on rising costs? Call on Clearing. We'd like to talk. No obligation, of course.





New Transfer-matic Combines Chucking with Drilling, Broaching and Assembly

Cross Introduces Building Blocks for Chucking Operations

This Transfer-matic starts with rough castings and completely finishes wheel hubs ready for final assembly. Operations consist of turning, boring, facing, drilling, broaching, and assembly of studs. Capacity at 100% efficiency is 200 parts per hour.

New Cross building blocks for chucking operations make this combination of work possible. Like other Cross building blocks, they can be rearranged as requirements change.

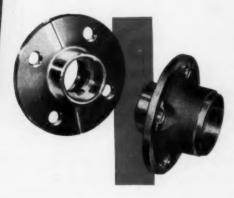
Advantages of the new Transfer-matic include maximum accuracy and uniformity, higher output, less handling, and faster production than conventional methods.

Heavy duty, three jaw chucks are used on the roughing operations but diaphragm types are employed for finishing to avoid clamping distortion.

A work bank between Sections I and II permits independent operation of either one during maintenance.

The new building blocks include a novel slide unit which tilts the tools upward to speed changes.

Cross engineers will gladly discuss details of this Transfer-matic with you.



Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION . DETROIT 5. MICHIGAN

"The No. 3's split the tenths!"

So report users of Moore's New Jig Borer and Jig Grinder



"Our operators feel that these are the bost machines they have ever worked on. They take care of the tenth-splitting tolerances required by industry today. Over the years we have enlarged our Moore Jig Boring and Jig Grinding Department to 15 machines." These are the words of Herbert Harig, President (left above), and Karl Harig, Chairman (at right), Harig Manufacturing Corporation, Chicago, Illinois.



You will easily break the "tenth" barrier with this accurate machine. No gibs...no overhang...improved drive...speed range of 60 to 2250 RPM...11 x 24" table working surface. It bores, drills, reams and spots holes in dies, jigs and production parts with unequalled speed and accuracy.



With this new, larger No. 3 model, you can grind—with split-tenth accuracy—holes plus regular and irregular contours to size and location after hardening. Faster strokes are provided for chop-grinding...infinite spindle speeds, 40 to 250 RPM...larger table working surface, 11 x 24".

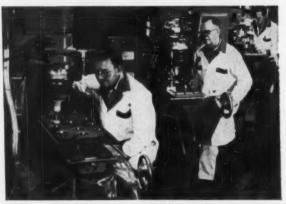
All hardened, ground and lapped ways. Made and calibrated to the new international inch.

Write today for literature describing the many advantages of the No. 3 Moore Jig Borers and Jig Grinders.

MOORE SPECIAL TOOL COMPANY, INC. 800 Union Avenue, Bridgeport 7, Conn.



Among the highly skilled toolroom operators in the Federal Products Corporation, Providence, Rhode Island, is this talented jig grinder operator, Mrs. Florence Smith, Mrs. Smith achieves ultra-precise results with the No. 3 Moore Jig Grinder.



"We have found that it costs real dollars and cents to operate without Moore equipment. This cost factor is just one of many reasons why we recently added the new Moore Model No. 3 Jig Grinder. This Machine, with its tenth-splitting accuracy, hardened ways and wider range, enables us to service more customers better." Statement by Val Koller, President, Koller Die & Tool Co., Milwaukee, Wisconsin.



in U.S.A., \$6 elsewhere.

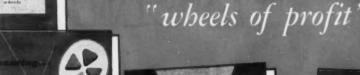
HOLES, CONTOURS AND SURFACES, Moore's authoritative book, tells how to produce tools, dies and precision parts the modern way. 424 pages, 495 illustrations. \$5

ADD CHARLE

TO YOUR TOOLROOM

JIG BORERS . JIG GRINDERS . PANTOGRAPH WHEEL DRESSERS . PRECISION ROTARY TABLES . HOLE LOCATION ACCESSORIES

YOURS..... a library of literature on MACKLIN





B-20



Looking for new economics in your production grinding? The answers you've been looking for may well be in this new Macklin literature. It contains specific wheel recommendations for various operations, and is documented with actual case histories showing cost-saving applications.

YOURS FOR THE ASKING

Literature on () Snagging Wheels () Tumbling Media

- () Cylindrical Gringing Wheels () Centerless Grinding Wheels
- () Disc Grinding Wheels () Roll Grinding Wheels
- () Reinforced Resinoid and Resin Impregnated Fabric Laminate Wheels

CONTACT YOUR LOCAL MACKLIN DISTRIBUTOR. Just tell him what you want. Or, if you prefer, we'll send it direct.

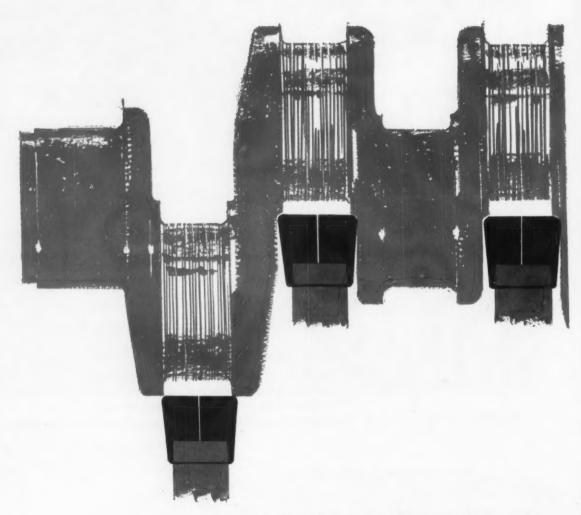
Circle Page 29 On Card



Dept. 14, Jackson, Michigan

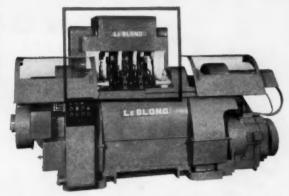
LeBlond announces

PAGRAGE



The R.K. LeBlond Machine Tool Company, Cincinnati 8,

TOOLING



A new concept in crankshaft turning

Automatic machining plus quick and easy tooling changeover—this is the unusual combination of advantages of our new 6PC Pin Turning Lathe.

All tooling, slides and master crankshafts are contained in a package unit which can be removed and a new tooling package installed in a few hours.

By this "package tooling" concept we eliminate the time delay heretofore required to send crankshaft machines back to the manufacturer for rebuilding. In addition, capital outlay is substantially less when you purchase a new tooling package and install it in your plant.

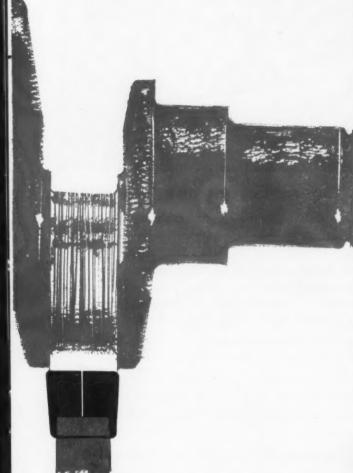
> These packages are interchangeable so that any combination can be used to suit your needs. For example, you could have one base and three different tooling units. Additional packages or bases can be ordered at any time.

> The LeBlond 6PC turns pin

bearings, faces adjacent counterweight lobes, or both in a single machining cycle. It will handle forged or cast crankshafts with 2, 3, 4, 6, or 8 pins. It will accept cranks from 12" to 41" long with bearing diameters up to 5".

Production rates will range from 10 to 40 per hour depending upon material, number of pins and webs to be machined, length of web cut, etc.

If flexibility is more important than maximum production rate in your shop, we would like to discuss the 6PC with you. Our latest catalog describes this new machine as well as our high production crankshaft lathes. Ask your nearby representative or write.



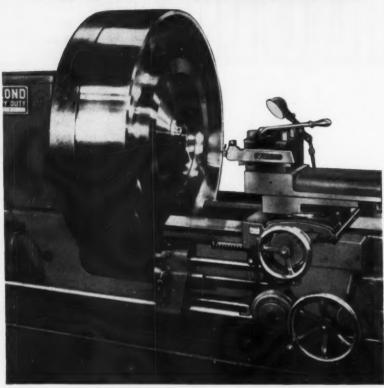
Ohio World's largest builder of crankshaft lathes



ARMSTRONG







A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with adequate numbers of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for every standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

Check over your ARMSTRONG Tool Holder needs.

Write for literature.

ARMSTRONG BROS. TOOL CO. 5213 W. ARMSTRONG AVE. CHICAGO 46, ILL.

32



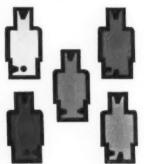
Versatile, top quality V5, X5 line offers wide range of options

Skinner's two-way and three-way V5, X5 series of solenoid valves has earned the description-"The Universal Line." With more than 100,000 variations possible, V5, X5 valves are available for every conceivable application. And top quality is emphasized with bubbletight sealing, and stainless steel body, plunger and sleeve assembly. Precision machining, unique welding techniques, specially designed and developed machinery and manufacturing methods are all used by Skinner to produce the best valves made. These valves are small, yet handle operating pressures as high as 3000 psi. They accommodate all media that do not corrode stainless steel. And no other solenoid valves offer so many optional features. Check the following options.



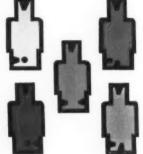
FLOW CONTROL

Precise, accurate control of media flow is possible with all Skinner V5, X5 valves. Both two-way and three-way valves are available with adjustable flow in the main stream, and with manual override. Two-way valves are also available with adjustable bypass. Exhaust flow can be controlled in three-way valves.



PORTING

Restrictions of installation or application, and mounting are minimized because Skinner provides a wide variety of port location options, V5, X5 valves are available with ports at right or left angles, on bottom, top, and sides for virtually all combinations of flow.



COILS

Skinner V5, X5 valves are available with coils of many types for most DC and AC voltages at 25, 50 and 60 cycle frequencies. Whether your requirements are for continuous or intermittent performance, in tropical, high moisture or high temperature environments, or for dual voltage, Skinner UL approved coils are available with leads of several types and lengths.



ELECTRICAL HOUSINGS

Skinner offers an electrical housing for any application. Some of the most common are:

standard 1/2" NPT conduit grommet outlet. single or double automotive terminals JIC housings with integral junction box AN connector for military applications

strain relief connector for quick disconnect All housings are steel, plated for wear and appearance, and can be rotated 360° for easy installation.

MOUNTING

Skinner V5, X5 valves are provided with tapped holes for normal mounting, with mounting brackets for panel or other surface, or with flange for direct mounting without threaded pipe connections.

The Skinner V5, X5 series of two-way and three-way solenoid valves provides top quality design with orifices from ½" to ¾" diameter, normally open, normally closed, dual purpose, directional con-



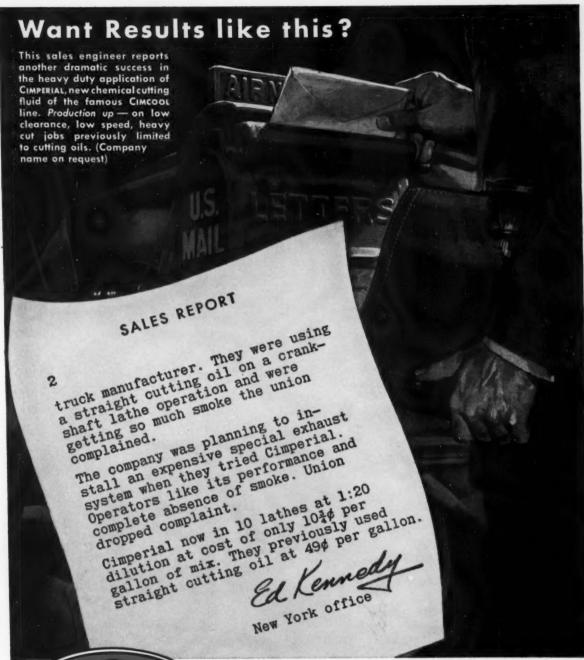
trol and multi-purpose, in standard and explosion-proof construction. Also included in this line is a three-way quick-exhaust type which is designed with an additional port to exhaust cylinders 4 times faster than standard types.

Typical applications-machine tools, cylinder control, instrumentation and automation of all kinds, laundry equipment, aircraft and missiles, etc. For catalogs and complete information contact a Skinner Distributor listed in the Yellow Pages or write us at the address below.

When you specify solenoid valves, specify Skinner. Skinner solenoid valves are distributed internationally.



THE CREST OF QUALITY THE SKINNER CHUCK COMPANY . NEW BRITAIN, CONNECTICUT, U.S.A.





FOR 100% OF ALL METAL CUTTING JOBS

Production-proved products of The Cincinnati Milling Machine Co.

CIMCOOL 52 Concentrate — The pink fluid which covers 85% of all metal cutting jobs.

CIMPERIAL 0 — Newest in the famous, industry-proven line of CIMCOOL 0 Cutting Fluids.

CIMPLUS — The transparent grinding fluid which provides exceptional rust control.

CIMCUT Concentrates (AA, NC, 55) — For every job requiring an oil-base cutting fluid.

ALSO — CIMCOOL Tapping Compound — CIMCOOL Bactericide — CIMCOOL Machine Cleaner.

For full information on the complete family of CIMCOOL Cutting Fluids, call your CIMCOOL Distributor. Or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

**Trade Marks Reg. U. S. Pat. Off.

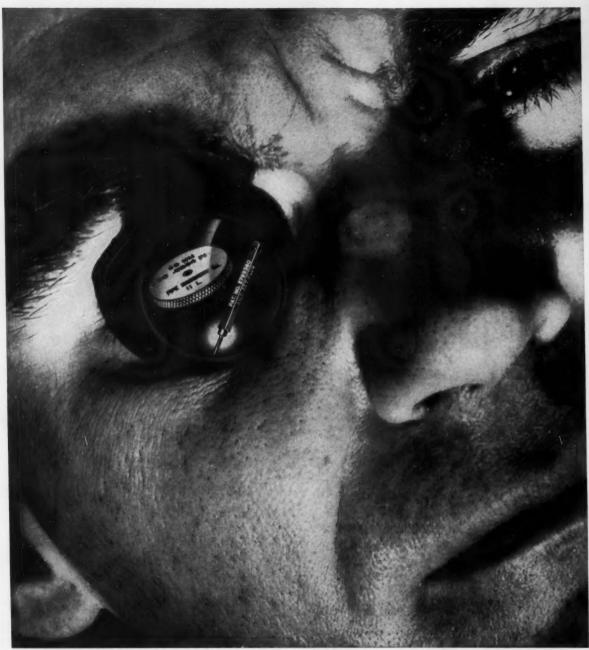
Blanchard proudly introduces the No. 27-48 and No. 27-60 Blanchard Surface Grinders,

which offer new features and high-production capabilities that give you high-speed, precision grinding at lower-than-ever cost. These new Blanchards are of "dry base" design. All coolant and chips discharge from the grinder base. They are powered by a 60 or 75 HP main spindle motor. Coolant is directed both to the inside and outside of the grinding wheel. These features provide ample power, rigidity and coolant flow for heavy stock removal on a large variety of work pieces. The advanced design and careful construction of these machines assure you of great accuracy, extreme flatness and fine finish.

THE BLANCHARD MACHINE COMPANY 64 State Street, Cambridge 39, Mass., U. S. A.



V-561



Take A Close Look At Pipe Machinery's Small Thread Gages

... here's real craftsmanship! Extremely troublesome to many gage manufacturers, fine pitch threads in small diameters have long been a specialty at Pipe Machinery.

Hard to see in detail without a glass, such miniatures as those pictured above are made with the same painstaking attention to detail, the same dedication to quality and accuracy that go into all of our other gage products.

You'll find it pays to look to Pipe Machinery for small thread plug and ring gages that meet your strictest specifications for precision. For further information write us on your company letterhead today.

New Model 205 S-12 (5hp No. 2)

MORE PARTS FASTER

NEW S-12 series

knee type milling machines

Unquestionably your first impression of the clean, functional styling of these all-new "S-I2's" will be an immediate feeling of modern precision, strength, stability, and careful, thorough engineering. BUT — there's a lot more to these all-new "S-I2's" than first meets the eye! There are timesaving, production-boosting features incorporated in this all-new "S-I2 Series" that make it worthy of your most serious Consideration and Comparison if you have any thought of modernizing your plant facilities to increase productivity.

Here are but a few of the new "S-12 Series" features that can help you make more parts — faster.



SIMPLIFIED TRIP DOGS ...

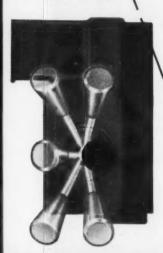
COMPARE K&T's exclusive AUTOCYCLE Control for production milling with knee type floxibility and versatility... more parts faster with ness effort, because idle time is automatically converted to cutting time. Four types of trip dogs — Feed, Rapid, Reverse, and Stop — mounted in a single slot on the from of the table, control a basic reciprocal automatic cycle. Automatic cycles can be to left and or right for either conventional or climb milling ... permit utilization of full table travel.





Available on

TOOL LEASE
Minimum Capital Investment
Your Choice of 3 Plans



SINGLE LEVER CONTROL...
COMPARE this new concept in single-lever control, the MONOLEVER, a Kearney & Trecker "First" in the industry. On all AUTOCYCLE "S-12"s." this single, sixposition lever controls table feed, rapid traverse, AND rapid traverse, and vertical head... is used for both manual or AUTOCYCLE control with equal advantage.

FEED CHANGE ...

COMPARE the speed and ease of the S-12 Feed Rate Change . . . a simple pull and furr with these large, easy - to - read Feed Range Dials through the shortest arc in either direction, and the S-12 is set to the desired feed rate. Changes are locked in without over-ride or

glare finish for easy reading ...
spring-loaded. Merely pull out and rotate to desired setting, and release for quick, positive-lock settings ...
graduated in .001 increments. Handwheels and handcranks do NOT spin during power feeds or rapid traverse.

coasting - change gears are hydraulically shifted and held.

COMPARE this S-12 fime-saver, Rapid-Set Micrometer Dials. Non-

QUICK-SET DIALS ...

This is but a brief look, a mere smattering of the outstanding features in-

corporated in these all-new S-12

Series machines. They're literally new from top to bottom, inside and out, for truly modern cost-saving, maintenance-saving, fast, accurate, profit-producing operation.

All we ask is that you Consider and Compare these all-new Kearney & Trecker S-12 Series Milling Machines. Discover for yourself that there are none newer... none finer... none better suited for increasing productivity.

To assist you, the facts for your Consideration and Comparison — Bulletin No. S-60, and RS-60 will be mailed promptly upon request.

Standard Machinery Division



ER ASSIST WE BEE

SPEED CHANGE...
COMPARE the easo
of the \$12 Speed
Change. Just a pull
and turn of this Juge.

through the abortest arc in either direction to select any of 24 speeds from 20 to 1900 RPM on the 255 S-12**. 24 speeds from 20 to 2400 RPM on the 367 S-12**. Speed changes are locked in without over-ride or coating. Shifting its smooth and quiet. Safety made during a cut.

AUTOWATIG

AUTOMATIC
BACKLESH ELIMINATOR...
COMPARE the S-12's Selfadjusting Automatic Backlash
Eliminator. Makes climb milling
just as easy as conventional milling. A mere twist of the wrist
sels it for instant use in reciprocal milling cycles.

KEARNEY & TRECKER CORP.

6800 W. NATIONAL AVE., MILWAUKEE 14, WIS. (or phone GReenfield 6-8300...direct Distance Dialing Code No. 414)

Deriving from well-known NADELLA Needle Thrust Bearings

HIGH-PRECISION
NEEDLE THRUST BEARINGS

ensure perfect axial retention of machine tool spindles and other high-precision rotating machine components.

Exceptional Load Capacity
Outstanding Rigidity even under Variable Load
Normal Tolerance ± .00004"
(closer tolerances on request)

Bearing precision completely unaffected by centrifugal forces acting on rolling elements. These thrust bearings are suitable for all normal speed ranges, including high-speed machining by carbide and ceramic cutting tools. NADELLA Needle Thrust Bearings meet tomorrow's machining precision requirements today. You can safely put your trust in the traditional craftsmanship and skill of Swiss precision engineering backed by NADELLA's 30 years experience in the production of needle bearings. Complete range of metric sizes from 15 mm (19/32") to 120 mm (4 3/4").



Some typical applications where NADELLA super-precision needle thrust bearings have scored:

- Precision lathe spindle, mounted on 35 mm (1 3/8") i. d. NADELLA needle thrust bearings. Excellent surface finish, outstanding dimensional accuracy of machined faces, direct finishing to chosed tolerances.

- Worm of indexing table for jigboring machine, mounted on 40 mm (1 9/16") i.d. NADELLA needle thrust bearings (ultraprecision grade). Indexing

00001"

- Milling machine spindle, mounted on 120 mm (4 3 4") i. d. NADELLA needle thrust bearings. Performance proved so satisfactory that preliminary rough machining passes produced a surface precision and finish equal to the finishing pass.

tinish equal to the tinishing pass.

- Work-holding spindle of grinder, mounted on 50 mm (2") i. d. NADELLA needle thrust bearings. Complete absence of lateral movement and outstanding dimensional accuracy in surface grinding; excellent surface finish.



WÄLZLAGERFABRIK BIEL A. G.

SOLOTHURNSTRASSE 66 68 - BIEL (SWITZERLAND) TEL. 032-4.20.31

IT'S A FAGT!

You can tap 1/2" holes with a light drill press and Supreme's

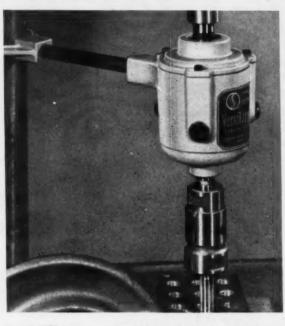
New VersaTAPPER



Shaft of Model 6100 is held in drill press chuck. No. 6200 (above) has Tapered spindle.



Supreme Accutap Chuck is standard equipment with VersaTAPPER. Capacity 0-1/2"



VersaTAPPER is a compact precision-made tapping unit. Fits any drill press... features 0 to $\frac{1}{2}$ "capacity range plus 4-time increase in torque. Easy to install. Simple and quick to remove after use.

VersaTAPPER...
operates easily in any material
...with widest capacity range
...yet costs far less

JUST 63

The new VersaTAPPER has scored an instant success with production people everywhere. It has more versatility than other tapping devices. It has the widest capacity range—from 0 to ½". It develops more power—makes the tapping of ½"-13 holes a simpler matter, even with light duty drill presses. VersaTAPPER is simple to use—can be successfully oper-

ated by anyone in your shop.

All of these features at the remarkably low price of \$63 complete marks VersaTAPPER as a product you must see at the first opportunity. It's available at your local Supreme Chuck distributor. Call him soon. Also check number on the reply card in this magazine for literature.

Supteme
PRODUCTS CORPORATION
CHICAGO

CHICAGO 16, ILLINOIS

You get more from power tools with Top Quality Supreme Accessories



Supreme Brand Chucks

Noted for unmatched quality. The widest range of sizes and types...one for every machine in your shop. Exclusive Supreme hardening means greater accuracy—longer wear.



Supreme Versamatic

Reversible speed reducer for portable drills. Fits all makes — permits their use for power screw driving, nutrunning and heavy duty drilling. 7 to 1 reduction means high torque increase. A fine tool.



Supreme Push-Pull Tapper

Like the Versamatic, but made for the single purpose of tapping with portable drills. Reverses instantly for tap removal. Handles taps up to 5/16" diameter. Top quality. Simple to operate.

SUPREME PRODUCTS

ARE IN STOCK IN
YOUR CITY.
CALL YOUR
DISTRIBUTOR
PRECISION ASR PRODUCTS

You can turn a profit on a New Britain +GF+ Copying Lathe

Here's a birdseye view of a New Britain +6F+ Copying Lathe. It shows some important differences between this machine and conventional lathes with copying attachments. The point here is this—the most effective use of the single-tool copy-turning principle can be made only with a machine designed from the ground up for this type of work. The New Britain +6F+ is just such a machine. Notice the chip pan. It's big (it has to be) and located for easy removal of chips from the back of the machine. The design of the work area allows for unobstructed free-fall of chips out of the way and into the pan.

The New Britain +6F+ is massive and rugged, with plenty of power—up to 40 h.p., if you need it. It's simple to operate, quick to set up and change over. The single-point tool can be changed in one minute and it out-produces gang tooling setups in the bargain. Turning is controlled by

either a template or a prototype. External and internal copying are accomplished in one set-up with special tooling.

The possibilities for short or long run chucked and between centers work on the +6F+ are wide and varied. Because the work is produced with good surface finish and dimensional accuracy, grinding can be reduced and, in some instances, eliminated. Large diameters are broken down economically by successive parallel cuts, automatically if desired, with optional two-cut or multi-cut recycling.

You've got to see one of these machines in action to fully understand the kind and quantity of work they are capable of producing. Contact your New Britain Representative for demonstration arrangements or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

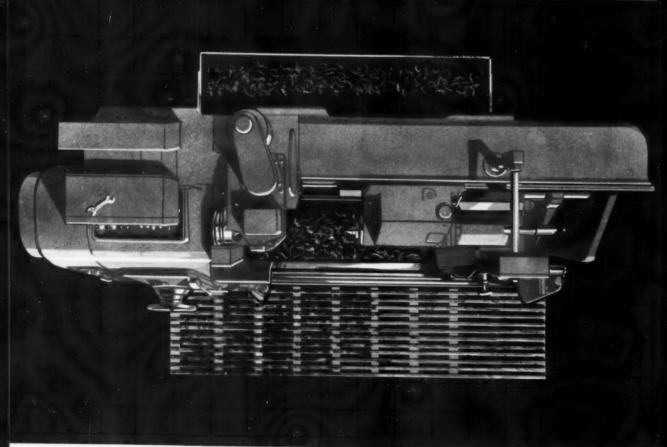
NEW BRITAIN . GRIDLEY MACHINE DIVISION

Unlimited tooling combinations with New Britain Bar Machines

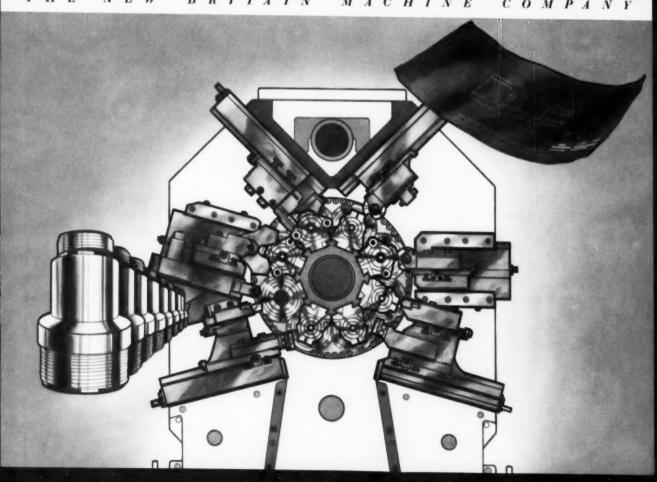
Nothing can out-date your operation quicker than better machines in the hands of a competitor. In the race to keep ahead on quality, price and delivery, nothing can put you out front faster than machines capable of consistently producing the highest quantity of finished pieces at the lowest possible cost. New Britain's new series of bar machines represents in every way the most advanced bar-turning units available. Each of the four-, six- and eight-spindle models has been redesigned, adding new features and improving older ones. Unlimited cross slide and end-working tool combinations, extremely fast operation (even on stainless) and a variety of models and features to choose from add up to some good reasons for incorporating New Britains into your replacement or production expansion plans.

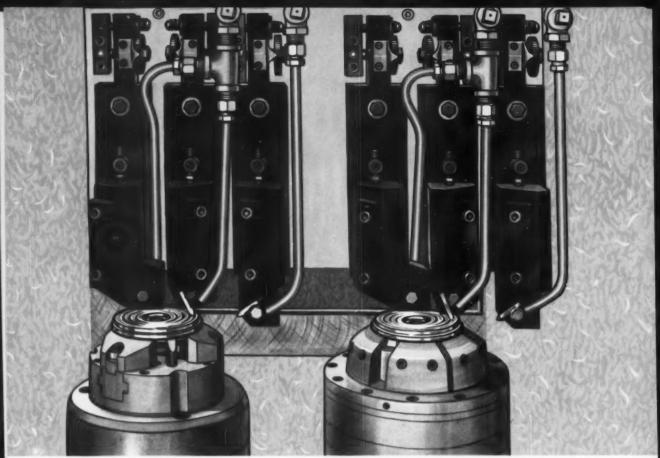
The eight-spindle model is the largest, most modern eight-spindle bar machine available. It has a stock capacity of up to 25%" and provides six independently-operated cross slides. As with all New Britain bar machines, the operations of the cross slides and end-working tool slide are disc-cam controlled for positive actuation, close tolerance machining and easy, rapid change-overs.

This is only a very small part of a story that is bound to interest you. The whole story and its significance in terms of your profits is available from your New Britain Representative. If you prefer, contact us directly at The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

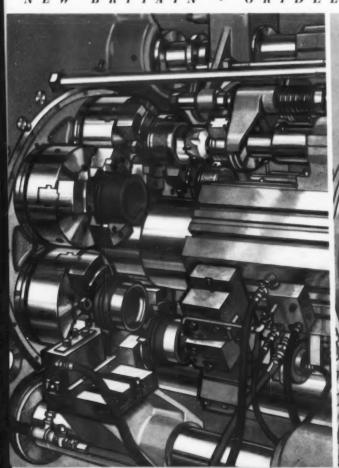


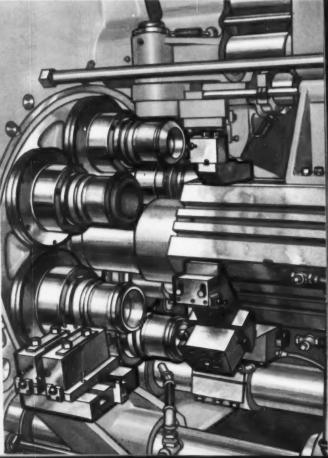
T H EN E W MACHINE COMPANY BRITAIN





NEW BRITAIN - GRIDLEY MACHINE DIVISION





New Britain's new concept for contour turning and boring

Beyond a certain point, continued refinement of existing designs in machine tools ceases to make an appreciable contribution to performance. Thus in designing our New Series of Vertical Precision Boring Machines, we have incorporated several completely new design concepts to provide improved performance and greatly increase over-all usefulness.

For the first time machines of this type can be used as building block units. Their clean-sided design permits any number of self-contained machines, each with one or more spindles, to be arranged side by side and operated as a single unit. They also may be operated with equal efficiency as individual machines. Parts can be inverted on adjacent machines or on adjacent spindles of the same machine.

In order to take the fullest advantage of the

precision inherent in cam control, long linkages between cams and slides have been eliminated. A pair of cams is mounted on a common shaft which is carried within the vertical slide. Since all slide actuating forces are contained in the vertical slide, both cams are directly adjacent to the slides they control and no outside forces are imposed on the slide ways. The result is maximum rigidity for heavy cuts coupled with extreme accuracy for close tolerance work.

This unique and eminently workable approach to contour turning and boring results in the highest order of accuracy on even the most complex pieces. Your New Britain Representative can give you details on the nine different models available in this series. For catalog material, write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Conn.

THE NEW BRITAIN MACHINE COMPANY

New Britain... still the best Chucker you can buy

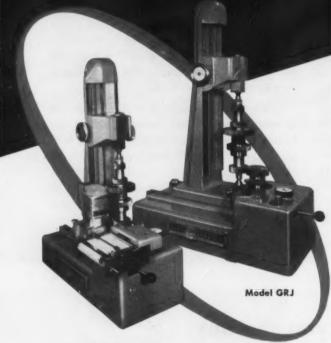
We're not unhappy about the fact that for years, in many plants, the name New Britain has been synonymous with chuckers. New Britain Chuckers have turned out literally millions of pieces of work for practically every major industry in the world. This is less important to the prospective buyer of one of these machines, however, than the capabilities of these machines today. How do they stack up against other chuckers or even other types of machines capable of doing similar work? Pretty well, we think.

New Britain's open-end design still can't be beat for unlimited accessibility to the tooling area. This same wide-open feature makes it doubly more practical to adapt these machines to automatic loading and unloading.

The unusual combination of longitudinal and transverse forming motions is another unbeatable New Britain feature. The massive forming arms on New Britain Chuckers allow heavier cuts and cuts of much greater complexity. This ability to do more work can eliminate the need for second operation machines in many instances. For really complex work, two chuckers set up side by side, as shown here, each doing one side of the piece, can smooth the way for high production. Less complicated work can be set up to perform both sides of the same piece on a single machine.

These massive machines provide the tooling combinations, spindle speeds and power to perform the widest possible variety of work. Their basic design will stay new for years to come, continuing to provide profitable operation. You may know New Britain Chuckers, but you may not be fully aware of the improved series presently being offered. Why not call your New Britain Representative or contact us at The New Britain Machine Company, New Britain-Gridley Machine Division. New Britain, Connecticut.

MEW RED RING Gear Rolling Fixtures



Model GRJ with motor drive and recorder



Model GRH with motor drive

These Red Ring Rolling Fixtures furnish a quick composite check of gear errors such as runout, tooth spacing, tooth profile, helix angle and tooth surface roughness. Model GRH is used for flat gears, Model GRJ for either flat gears or those having integral shafts.

Either model may be equipped with a constant-speed motor drive to eliminate the factor of non-uniform manual operation.



The motorized fixtures may also be equipped with a tape recorder for permanent inspection records.

For further information ask for Bulletin C 60-8

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING AND HONING EQUIPMENT

For more data circle this page number on card at back of book MACHINERY, January, 1961



Bethlehem circular forgings are available in carbon, alloy, and stainless steels, and some heatresistant grades. 10 to 48-in. OD. 100 to 2,000 lb. As-rolled or rough-machined to specifications.

Which cost less, castings or circular forgings?

In initial cost, a Bethlehem circular-forged blank is competitive with a cast blank.

But that's where the competition ends.

Due to the hot working of the metal (our unique Slick Mill forges and rolls a circular product in one operation in one minute), forgings have better physical properties, greater strength than castings.

HIGHER CUTTING SPEEDS—The uniform quality of Bethlehem circular forgings allows you to use higher cutting speeds. Machining time—both in roughing, and in hobbing

teeth—is cut; tool life is increased. And there's no chance of sand damaging valuable hobbing tools.

LESS METAL—You'll find, in many cases, weight can be reduced. The greater strength of a *forged* circular product permits thinner rim sections without sacrificing strength.

Our sales engineers will be happy to give you the whole story on Bethlehem circular forgings—competitive initial cost, sure machining savings, possible weight savings, a better-quality product all around.

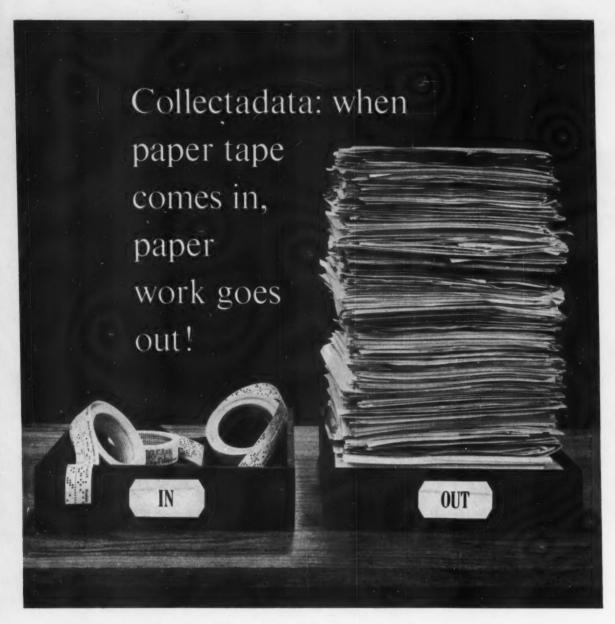
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Sales: Bethlehem Steel Export Corporation



BETHLEHEM STEEL







The machine at left is a Friden Collectadata® Transmitter, key to a new system of internal data collection that virtually eliminates in-plant paperwork.

The system is very simple. Transmitters, spotted in key reporting locations throughout the plant,

are cable-connected to a central Collectadata Receiver. "Blank forms" are issued as pre-coded tab cards or Friden edge-punched cards. Each card becomes a "filled-in" report after the worker inserts it in the transmitter, dials in any variables and touches a key. The rest is automatic. The receiver records each report in punched paper tape, adds an automatic time code. At day's end, the receiver tapes are processed—converted to tab cards or fed

into a computer to prepare complete operations reports.

Collectadata users report substantial savings in time and money. But in many applications the *speed*, accuracy and efficiency of automated data collection are even more significant. For information, consult your local Friden Systems Man. Or write: Friden, Inc., San Leandro, Calif.

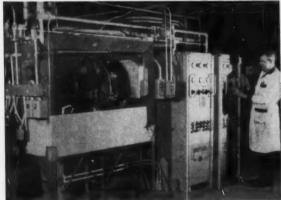
THIS IS PRACTIMATION: automation so hand-inhand with practicality there can be no other word for it.



SALES. SERVICE AND INSTRUCTION THROUGHOUT THE U.S. AND WORLD

Flame sprayed metal increases wear resistance better than 10 times

AIDS WEIGHT REDUCTION



Automatic setup for metallizing inner walls of aluminum cylinders used in lightweight gasoline engines. Cabinet in foreground houses six-station rotary setup; automatic control panels are at right.

Many methods, including cast-iron cylinder liners and chrome plating, have been tested for wear resistance in lightweight gasoline engine blocks of aluminum.

Best of these methods experienced breakdowns in less than 400 hours. Now they are metallized with METCO Sprabond (molybdenum alloy) as a bonding agent, followed by a coating of sprayed steel alloy.

Test runs of over 4,000 hours show little or no wear of the metallized surface. Finish thickness is .007"; weight – a few grams. Cast-iron liners weighed almost ½ pound.

Cylinder at left machined ready for flame spraying; one at right has been metallized and hone finished.







Closeup of automatic six-station rotary setup. Cylinders are individually rotated at 150 rpm. Cylinder is loaded on table at Station 1, moved through Stations 2 and 3 for pre-heating by torch. At Station 4, bonding coat is applied by the gun nozzle which feeds into the rotating cylinder. Low alloy steel is applied at Station 5 and cylinder cools at Station 6. Cylinder walls are finished by honling.

New engineering data bulletin

Bulletin 136B—The Merco Flame Spraying Processes, provides basic engineering and application data on flame sprayed coatings of metals, ceramics, carbides and other high melting point materials. 16 pages. Send coupon for free copy.

METCO INC.

WETCO

FORMERLY METALLIZING ENGINEERING CO., INC.
Flame Spray Equipment and Supplies
1131 Prospect Ave., Westbury, Long Island, N.Y.

Telephone: Edgewood 4-1300
In Great Britain: METCO, Ltd.
Chobham-near-Weking, England

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city	zone state

Sweet Music for Tomorrow



Machining a turntable in the Model Shop of V-M Corporation, Benton Harbor, Michigan.



Just as manufacturers the world over choose famous V-M Record Changers for their dependability and full fidelity of performance, V-M chooses South Bend 13" Toolroom Lathes.

They demand exacting model work and they get it on these precision lathes—every time. If your experimental or production work require exceptional tolerances and fine finishes, you'll be

interested in what you can accomplish on South Bends. Write now for complete information. Prices of 13" Toolroom Lathes start at \$2358, a time payment plan is available. **SOUTH BEND LATHE** SOUTH BEND LATHE, Inc.

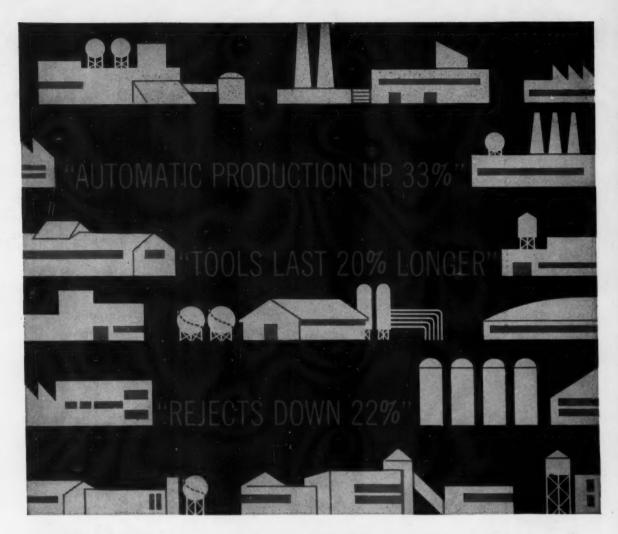


Builders of Lathes . Milling

For more data circle this page number on card at back of book

MACHINERY, January, 1961

Machines . Shapers . Drill Presses . Pedestal Grinders



Why in the past 12 months hundreds of PLANTS HAVE SWITCHED TO CLEARTEX!

These automatic screw machine users have found that tri-purpose Cleartex has ended the problem of cutting oil dilution.

Manufacturers have found that in 7 out of 10 automatics, lube oil leaks into the cutting oil sump in spite of the most careful lubricating techniques. This diluted cutting oil can cause shortened tool life and piled-up rejects.

New Texaco Cleartex has solved the problem forever for many manufacturers. They now use Cleartex for both cutting and lubricating, hence the leakage that occurs no longer dilutes the cutting oil quality. The exceptional chemical stability and load-carrying ability of the Cleartex series make them equally suitable for use as cutting oils, lubricants and even hydraulic fluids.

TRY THE "CLEARTEX CURE" YOURSELF. Write today for Texaco's booklet—"Cleartex in Automatic Screw

Machines." This illustrated guide will fill you in on the details, show you where you may be losing profits and

how to avoid it. Or contact your local Texaco Lubrication Engineer for an authoritative study of your automatics. Just call the nearest of the more than 2,300 Texaco Distributing Plants or write to:

Texaco Inc., 135 East 42nd Street, New York 17, New York.

Dept. MA-61.



Throughout the United States

Canada • Latin America • West Africa

15 years engineering and millions of dollars invested $\check{*}$ to perfect the world's finest brake...today's PACIFIC HYDRAULIC PRESS BRAKE

brakes in operation Over 9 out of every 10 hydraulic press today are PACIFIC providing ...

- More dependability
- Freedom of maintenance and leakage
- Simpler electric controls
- Simpler hydraulic control
- More accuracy in level control
- More accuracy in air bending
- More operating convenience
- More rigidity in cylinder Greater visability construction
- Shock-free hydraulic system suitable for



Maximum tonnage available throughout the full stroke permits use of deep dies in forming 13% cold rolled and man-ten high strength steel. Brake maintains .010% accuracy from one end of 20 foot long pieces to the other. Pieces can be formed by eye with minimum setup. The possibility of press brake jamming in forming heavy plate is eliminated at Clark Equipment Co., Construction Machinery Division, Benton Harbor, Michigan, by use of a PACIFIC hydraulic press brake. On overload resulting from normal variations in thicknesses of mill stock and in forming unknown alloys, the PACIFIC hydraulic ram eases up and does not continue to bottom of stroke. This avoids jamming and permanent damage that is unavoidable with machines required to complete each stroke.

ACIFIC PRESSES AND SHEAF PACIFIC INDUSTRIAL MFG. CO., OAKLAND, CALIF. PACIFIC PRESS AND SHEAR CORP., MT. CARMEL, ILL.

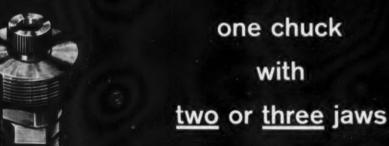
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ENABLED PACIFIC THIS INVESTMENT TO INTRODUCE:

- cylinders within .003" (1947) · Cushioned punching (1949) Tape control to synchronize
- · Precision depth control to repeat accuracy within .001" (1951)
- · Manual turnet stroke controls for Selective anti-whip speeds to progressive bending (1952).
- for forming piaces 40 ft. or longer * Tandem operation of press brakes eliminate reverse bends (1952)
- Tonnage control to protect light dies in heavy press (1953)
- Multiple hydraulic cushion cylinders for deep drawing (1954)
 - · Cylinder ram guides for increased · Overhead integral power unit for increased accuracy (1955)
- · Shearing attachment for shearing rigidity (1956)
- heavy plate on press brake (1958) · Pipeless stacking of valves to inate pipe breakage and

eliminate cause of leakage (1959) · Shockless hydraulic valving to





SKINNER DUAL PURPOSE POWER CHUCK

One Dual Purpose Power Chuck saves the cost of an additional chuck

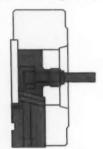
Skinner dual purpose standard power chuck is designed with four master jaws so that it may be used as a two or three jaw chuck. It is no longer necessary to pay for one chuck to machine round work, and an additional chuck to machine odd shapes and castings. Not only do you save the cost of an additional chuck but you get all of the advantages of Skinner power chuck design listed below. Skinner dual purpose power chucks are available with adjustable, non-adjustable, or serrated jaws, in sizes 8" to 36".



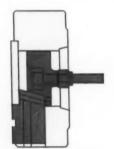
A—Transparent view of dual purpose power chuck B—Master Jaw C—Wedge D—Drawbar Stud and Wedge plug

Skinner wedge-type chuck offers these advantages

- Allows automation of long production runs.
- Reduces operator fatigue-air performs the muscle
- Adjustable gripping pressure—air pressure can be adjusted for light or heavy chucking-is not left to the judgment of the machine operator.
- Work can be gripped internally or externally.
- Assured continued high accuracy because of wedge design (see illustration).
- Reduced wear because of hardened parts-models available with flame hardened center hole and jaw locks.
- Complete line-heavy and light duty models in sizes from 4" through 36".



Wedge at top of strokejaws fully open



Wedge at bottom of strokejaws fully closed (External gripping)

The wedge and three jaws-only four moving partsoperate as a collet does with accuracy maintained over the whole range. The wedge angle is 14° which was found to be the most efficient angle for maximum power and jaw travel. With this wedge construction, the grip of a Skinner power chuck holds as set-even if the air line is broken-until opening power is applied in the opposite direction.

Skinner Power Chuck Accessories



Double-Acting Rotating Air Cylinders for use with power chucks and fixtures provide maximum pressure with a minimum amount of air. Cylinder walls are burnished to provide maximum sealing life. Cylinders in sizes 6 to 18 with semi-steel bodies are designed for low speed operation.

Aluminum body cylinders in sizes 4 to 20 are designed for high speed operation.

Packaged Power Chucking Assemblies are available for Atlas, Cintilathe, Hardinge, Logan, Regal, Sheldon, South Bend, and many similar lathes. Assemblies are also available for Brown & Sharpe and similar automatic and hand screw

machines to permit chucking of cold drawn parts, small or odd shapes and castings. Packaged assemblies consist of chuck with two or three jaws, threaded drawbar or drawtube, rotating air cylinder, cylinder adapter and necessary mounting for the individual machine

Power Chuck Fixture, air or hydrau-

lically operated, holds work for drilling and milling machines and for other bench and machine installations. Available in many jaw types in sizes 5" to 36".

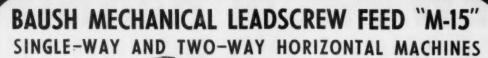
A Complete Line of power chucking accessories includes hand, foot, and solenoid valves, drawbars, air units, and soft blank top jaws.

For complete information about the Dual Purpose and other power chucks and power chuck equipment, contact your Skinner Representative, Distributor, or write us at the address below.



THE CREST OF QUALITY

SKINNER PRECISION INDUSTRIES, INC. . NEW BRITAIN, CONNECTICUT, U.S.A.



The "M-15" Units used on both these machines are extremely versatile—positive in action—trouble free—fast operating and can be mounted vertically, horizontally, or at any angle needed for specific machine designs. These Units are also available in 10 H.P. to 40 H.P. capacity to meet requirements.

When head goes from rapid traverse to feed stroke, an electric brake

holds leadscrew and shuts off traverse motor — saving wear and tear. "M-15" Units are the answer to high production at lowest cost.

Machines illustrated can be arranged for both drilling and tapping. The M-15 Units are positive in operation as feed is geared directly to spindle drive gear.

Each of these machines has a completely automatic cycle for highspeed operation and a semi-automatic cycle for low-speed production and features 2 independent spindle speeds plus a neutral position for each spindle.

MECHANICAL LEADSCREW FEED

is an exclusive with BAUSH.

Many commendable reports have been received from users as to their numerous advantages:

No hydraulic fluid

No fluid leaks or fluctuation in feed

Indirect maintenance costs reduced

Your own mechanic can maintain unit

Positive feed_thru ball-screw

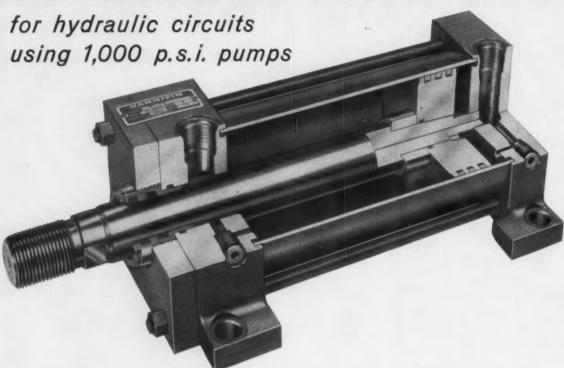
Break-thru surge eliminated

Drill breakage and part spoilage reduced to minimum.

BAUSH

SPRINGFIELD 7, MASSACHUSETTS

NEW FROM HANNIFINTHE THOUSAND POUND LINE!



- A true hydraulic cylinder
 not a modified air cylinder
- Offered in nine bore sizes
 1" through 8"
- Every model withstands at least 1,000 p.s.i. in every bore size
- Built to save you money yet not "built to a price"

Now, for the first time in hydraulic cylinder manufacture, Hannifin offers a top quality cylinder tailored to the medium-high-pressure hydraulic circuits you operate off 1,000 p.s.i. pumps.

Series "L," the "Thousand Pound Line," is NOT a modified heavy duty air cylinder. It is built for the job... with steel heads and steel barrel for full compliance with J.I.C. hydraulic recommendations. Other extraquality features include an induction hardened and hard chrome plated rod, nodular iron piston with cast-iron piston rings — leakproof "Lipseals"," optional — longer cushions on cushioned models, and the Hannifin-developed bronze cartridge gland with both "Lipseals" and "Wiperseal" to keep the rod drip-free. S.A.E. straight thread "O" ring ports as recommended by J.I.C. are optional at no extra cost just as they are in the Hannifin heavy duty Series "H" hydraulic cylinder.

Parker-Hannifin field engineering service can help you meet your needs precisely, help you select the proper Hannifin cylinder for any service, air or hydraulic. Call your nearest Parker-Hannifin sales office or write direct for our new bulletin giving all dimensions of Hannifin Series "L" cylinders.



HANNIEIN COMPANY

A DIVISION

509 South Wolf Road . Des Plaines, Illinois

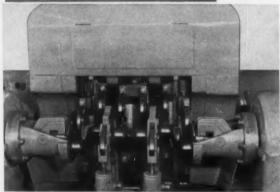
EUMATIC AND HYDRAULIC SYSTEM COMPONENTS

9077-1918



QUICK-CHANGE VERSATILITY!





Yours since 1955 with **WICKES** highly versatile MP-4 cartridgetype Crankshaft lathe.

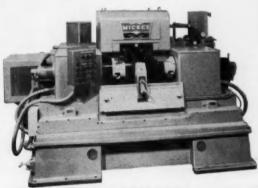
1955 produced a forecast of the future when WICKESmanship developed and introduced the highly adaptable MP-4 Crankpin turning lathe. A true quick-change artist, the MP-4, utilizing a master crankshaft as a template, is designed to turn three different types of crank shafts, turning and cheeking all crank pins at one time. A quick change of the center section on the MP-4 accommodates different spacing of crank pins, as well as different strokes. Master crankshafts can also be changed quickly to handle crankshafts of identical design but with different strokes. Production efficiency proven in steel . . . and on the job . . . since 1955!

The center section ... heart of the MP-4... can be changed in 4 hours, master crankshafts changed in 2 hours! These are actual changeover times clocked on the job. Your WICKESman is ready to show you how the versattle MP-4 lathe . . . developed by WICKESmanship in 1955 . . . can truly cut your production time and costs in the 60's. Call him today,



division of the

515 N. WASHINGTON AVE. SAGINAW, MICHIGAN PHONE PLeasant 7-0411



MP-3... MP-8... and ... MP-10 models are also available in this production-proven series.

WICKES corporation



"More than a century of machine tool progress".



STEELWELD SHEAR

Operates 16 Hours a Day Prefabricated Buildings



Cutting and slitting operations normally keep this Steelweld Shear busy 16 hours a day. It is equipped with Steelweld's popular Micro-Set Knife Adjustment. This permits adjusting the knife clearance to suit the thickness of metal being cut in the matter of seconds. Thus, the finest cuts are assured for every shearing job.

A recent Pascoe Building.

RAPIDLY forging ahead in the prefabricated steel building field, Pascoe Steel Corporation, Pomona, California, has found its Steelweld Shear to be an extremely important factor in maintaining a steady rate of production. A large amount of shearing is required to fabricate several hundred tons of steel per month.

The Shear is normally operated 16 hours a day. It is used for cutting web plates for building columns, rafters and many other building components. About 20 hours a week it is used for slitting. The machine has functioned with very little maintenance. In nearly three years of service, the clutch has never required adjustment.

For the very latest in shears and brakes. mechanically or hydraulically operated, be sure to see what Steelweld has to offer.

O BLADE



Steelweld Machinery Includes: Mechanizal & Hydraulic Shears and Press Brakes, One-, Two- and Four-Peint Straight-Side Presses, Speed-Draw Presses.

STEELWELD MACHINERY DIVISION . THE CLEVELAND CRANE & ENGINEERING CO. . 5459 E. 282 ST. . WICKLIFFE, OHIO

58

IT'S NEW IT'S VERSATILE IT'S AMERICAN

... and it's designed from the ground up to give you faster, more economical, more automatic production.

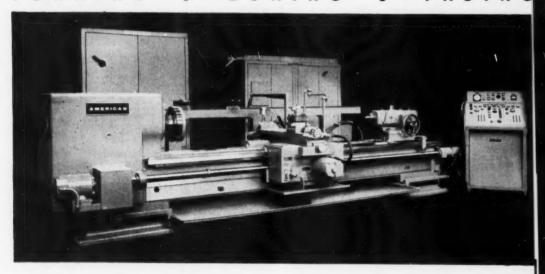
Here's a production athlete with both muscle and brains. A punched tape keeps it humming.

20 spindle speeds and 20 feed rates, tape selected. Spindle drive by a 50 H.P. constant H.P. variable speed reversing motor. Square turret is tape controlled. Lathe has hardened and ground cross and longitudinal Ball Screws. Tape preparation requires no computers. Simple to operate. Error free. Write for Bulletin 912-A.



THE AMERICAN
2509 TAPE
CONTROLLED LATHE

TURNING . BORING . FACING



This and all other AMERICAN machine tools are available on "Toolease," our popular leasing plan. Send for Bulletin 801 for details.

COMPETE COMPETENTLY WITH

AMERICAN

LATHES . RADIAL DRILLS SPECIAL MACHINES



The American Tool Works Company

Pearl Street at Eggleston Avenue

Cincinnati 2, Ohio

TOOLING WITH TAPE

... the way to get dollars out of nonproductive metal and into money-making machine tools

You are looking at a \$12,000 scrap heap of jigs which have been replaced by punched paper tape costing only \$500 to program and produce.

The costly jigs were used simply to position cutting tools on hole work. Now, with a tape-controlled Giddings & Lewis horizontal boring, drilling, and milling machine, tools are automatically positioned with extreme accuracies.

But the tape not only replaces the jigs, it does far more. Inaccuracies requiring corrections on the assembly floor are a thing of the past. Certain checking operations and large gages are eliminated. Sequence of operations, feeds and speeds for drilling and boring, and feed rates and end points

for milling work all are programmed for optimum production.

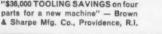
The tape-controlled machine does more work in a day - in less space - at lower cost than the machine-plus-jigs which it replaced.

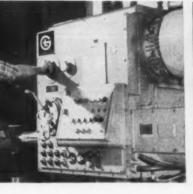
The arithmetic works out well. Users of G&L tape-controlled machine tools are regaining their total investment in as little as one to four years through time and tooling savings alone.

Tape control has "arrived" - to give you a cost and competitive advantage. For complete details and literature, call your Giddings & Lewis distributor or write to Giddings & Lewis Machine Tool Company, Fond du Lac, Wisconsin.

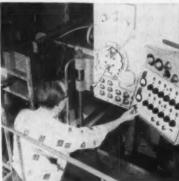
GIDDINGS & LEWIS

"\$36,000 TOOLING SAVINGS on four parts for a new machine"

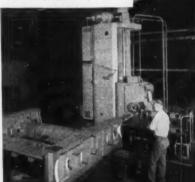




"ELIMINATED FIXTURES that took as long to make as the part itself"—The Budd Company, Philadelphia, Pa.



"SAVED \$130,000 on tooling for one new product"-The Goss Company, Chicago, III.



"\$12,111.48 IN JIGS TRADED FOR \$513.20 WORTH OF TAPE" - The Goss Company, Chicago, III.

EXPERIENCE

to help you into tape

from the people who developed the first commercially available numerically controlled machine tool

There is a profitable place for numerical control nearly everywhere that short-run machining is done. But the final decision to go into tape is dependent upon a number of economic and manufacturing considerations. You can come with confidence to Giddings & Lewis to discuss these considerations.

G&L pioneered tape-controlled machine tools . . . has produced more major machines with numerical control than any other builder . . . has developed its own control systems . . . uses tape-controlled machines extensively in its own shops . . . and has established a numerical control research, development, testing, and programming center unique in the industry.

Every one of the following types of machines was first made available with tape control by Giddings & Lewis: contour milling machine, vertical boring mill, vertical turret lathe, die sinking machine, and horizontal boring, drilling, and milling machine.

For experienced answers to your tape control questions, consult your Giddings & Lewis distributor or the factory.

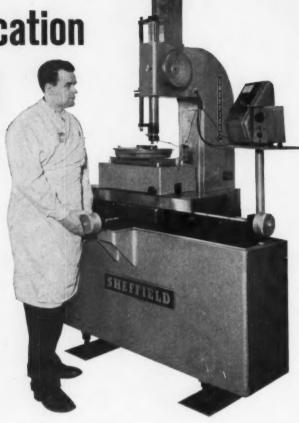
GIDDINGS & LEWIS MACHINE TOOL COMPANY, Fond du Lac, Wisconsin

Combination jig-borer and milling machine; horizontal boring, drilling, and milling machines; vertical turret lathes; vertical boring mills; positioning tables; dei sinking machines; contour milling machines; radial and upright drilling machines; planera; planer mills; numerical and tracer control systems; Davis boring tools.



Difficult hole location problems solved for short runs





At the Westinghouse Ordnance Plant, Lansdowne, Maryland, a Sheffield Coordinate Measuring Machine determines the true location of 18 holes in a magnesium integrator or gear box. Fifteen holes are checked to ±.00017; two holes to ±.00023; and 1 to ±.000075 (75 millionths).

Inspection with a height gage and setting master previously took two days and did not determine out-of-round condition. The Sheffield gage reduced the time to six hours including set-up and cooling out—and checked for out of roundness as well. Over-

NEWS: Before 11:00 a.m. on the first day of the NMTB Exposition in Chicago, September 6, 1960, a Fort Wayne, Indiana manufacturer bought a similar machine being demonstrated in the Sheffield booth. Additional orders continue to come in.

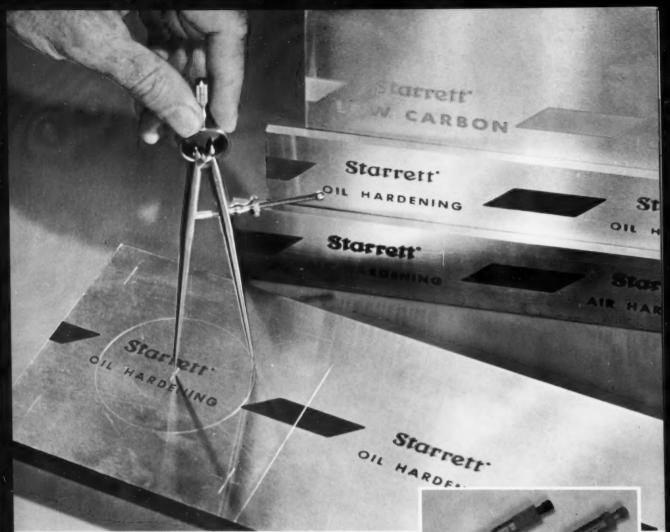
all accuracy of the gage has proved to be within .000075 on both horizontal axes and in the 10" vertical range. Repeatability is within .000010.

100% of the parts which passed inspection on this Coordinate Measuring Machine proved to be perfect in assembly, test, and field use. Short production runs of parts that vary widely in size and hole location, are easily handled.

Write for catalog number P-193 or check with your nearby Sheffield representative on your gaging requirements.



A subsidiary of The Bendix Corporation



PRECISION GROUND DIE AND FLAT STOCK - Starrett No. 496 Oil Hardening, No. 497 Air Hardening and No. 498 Low Carbon Flat Stock.

precision made by Starrett

to speed precision work

Flat stock and die stock made to exacting Starrett metallurgical specifications . . . precision ground to Starrett standards of dimensional accuracy . . . available in well over 1,000 sizes in air, oil and water hardening tool and die steel types and in free machining-low carbon flat stock . . . available through your nearby Industrial Supply Distributor ready to lay it out and cut it out.

Just one of the many ways Starrett helps you speed and simplify precision work with a complete line of products of unsurpassed quality. Write for complete Catalog No. 27. Address Dept. D, The L. S. Starrett Company, Athol, Mass., U.S. A.

World's Greatest Toolmakers





HACKSAWS, HOLE SAWS, BAND SAWS, BAND KNIVES





- cutting conditions, instantly selected.
- Fast Table Reversals, no electrical contactors to wear-out.
- Planer Accuracies and Capacities at Shaper Cost.

Check your production requirements and operating efficiency with one of our engineers, and permit him to quote you the cost of owning and operating one of these modern production machines. Then, make any comparisons you desire, and the answer will inevitably reflect the advantages of Rockford Hydraulic design.

ROCKFORD MACHINE TOOL CO., ROCKFORD, ILLINOIS

Rear View shows massive column with rigid railbrace. Climb milling in either direction to full overload capacity B&S No. 12 Plain Milling Machine

BROWN & SHARPE









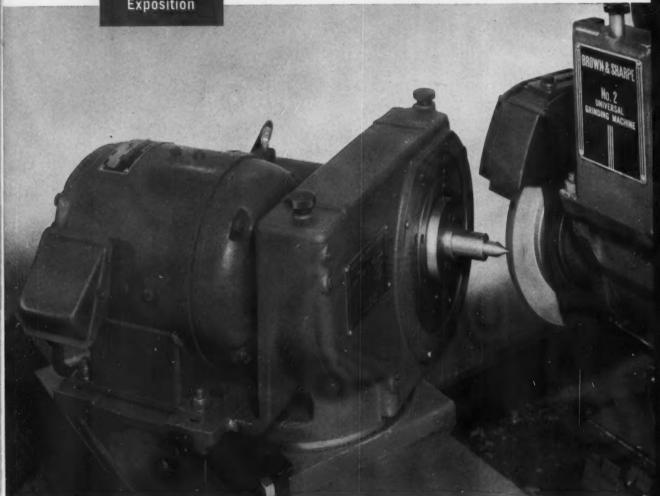








TO HELP YOU GRIND MORE FOR LESS



New Supercise Headstock for B & S Universal Grinders repeats size and roundness within ten millionths



Test chart indicates true roundness within 5 millionths of an inch.

With this new B&S designed hydrostatic headstock, grinding to split-tenth precision in size and roundness, with super-finish, can now be maintained in production runs, with average operators. The unique hydrostatic bearings automatically compensate for minute errors and assure accuracy well beyond the limitations previously considered normal. Contact wear of the spindle is virtually eliminated, and accuracy is maintained through years of constant use.

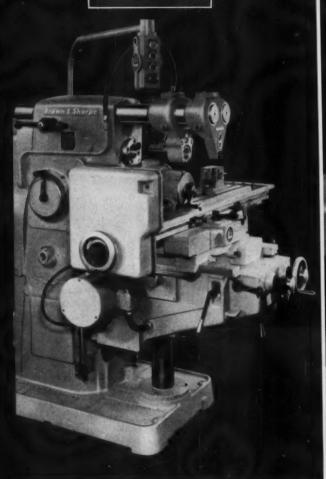
The Supercise headstock is available as special equipment on the No. 2, 3 and 4 Universal Grinding Machines. It adds another to the many exclusive features of B&S Universal design that frequently permit job-time savings of 75% or more.

You need all these extra B&S design advantages, when you select Universal Grinders for toolroom, prototype operations, or production grinding. Why settle for less? For details write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe PREGISION GENTER



TO HELP YOU MILL MORE FOR LESS



NEW B&S No. 2 Universal Milling Machine

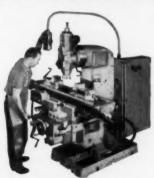
NEW B&S No. 2 Plain Milling Machine

New DYNAMASTER design "tailors" machine to fit the job you buy only needed features - from 132 combinations

The Brown & Sharpe DYNAMASTER series is an entirely new concept in kneetype milling machine design. You can order any of 132 combinations of standard features, in 14 models of Plain, Universal, Vertical, and Rangemaster. You can also select the drive you need — 3, 5, 7.5 or dual 10/5 HP.

In every DYNAMASTER, you get heavier, balanced construction that puts the weight where it's needed - permits you to take full advantage of the fast-cutting potential of carbide and coarse-tooth cutters. Hydraulic gear shifting, and many other control improvements, set new standards of operating ease and simplicity.

Before you invest in milling equipment, get the complete story of the 27 design improvements, with 9 important advantages available only in a DYNAMASTER. For toolroom — maintenance — prototype work — short or long run production — the dollar-wise buy is a DYNAMASTER. For details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.



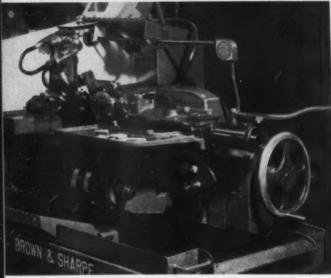
NEW B&S No. 2 Vertical Milling Machine

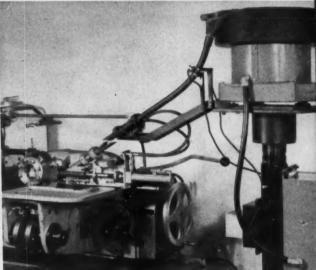




TO HELP YOU MAKE MORE FOR LESS WITH SCREW MACHINES







B & S Automatics provide new cost-saving advantages for any type of screw machine work

The new design features, attachments, and feeding devices demonstrated at the Chicago Exposition offer every screw machine user spectacular opportunities for big savings. You can include more operations in bar work and boost production speed. You can cut loading time more than 50% in second operation work.

With new design B&S Automatics and accessories, you can make daily dollar savings, and write off your investment in record time. Get details. Write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Ask for information on NEW faster feeding at 10,000 R.P.M. with Automatic Bar Feed Magazine · NEW drilling and broaching attachment that permits punch broaching with 18,000 lbs. air pressure . NEW Automatic Hopper Feeder for second operation work that cuts loading time more than 50% . NEW electronic gaging that checks every piece . NEW fourth slide, with 2 tool holders, that permits added operations in cycle.

Brown & Sharpe Pregision Genter



TO HELP YOU GRIND MORE FOR LESS



New Brown & Sharpe 1030 MICROMASTER Surface Grinding Machine

New profit-saving Surface Grinders for larger work - the B&S 824, 1024 and 1030 MICROMASTERS



Elimination of saddle (no table twist) assures accurate grinding of parallel, vertical surfaces.

Ever since the introduction of the 618 MICROMASTER, demand has steadily increased for larger capacity B&S Surface Grinders with the same profit-saving, super-precision performance. Now, they are ready — in 8" x 24", 10" x 24", and 10" x 30" sizes. You get full hydraulic control with table speeds from 10 to 125 fpm, and a generous 14½" capacity under a 12" wheel.

The broad based, rugged construction assures lasting precision to ten-

The broad based, rugged construction assures lasting precision to tenthousandths, and flawless microinch finishes. You can choose the 5HP direct drive, or the 3HP Oriflex drive, according to your needs. All basic controls are at the operator's fingertips.

You can order your MICROMASTER with any of a wide selection of optional equipment, or factory-modified to give you exactly the machine you need. Why settle for less — or more?

Why settle for less — or more?

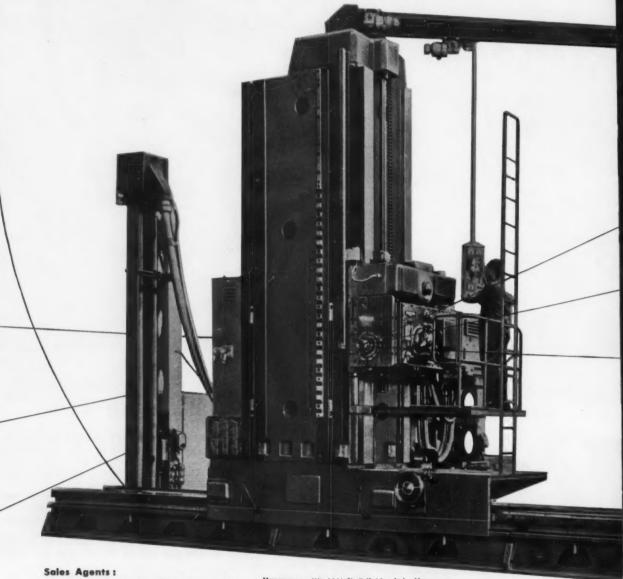
For full information, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

Brown & Sharpe Precision Center

MITSUBISHI INNOCENTI CWB

milling boring

MITSUBISHI ZOSEN KABUSHIKI KAISHA (Mitsubishi Shipbuilding & Engineering Co., Ltd.) take pleasur in announcing the conclusion of a license agreement with INNOCENTI S.G. of Milano for the manufacture an world-wide distribution of the universally known INNOCENTI-CWB MILLING, BORING & COMBINEI MACHINES. The machines will be produced in Floor Type, Planer Type and other Combination Types, the diameters of spindles being 140 mm for milling and 95 mm for boring.



New York: Mitsubishi International Corp., 120 Broadway, New York 5, N.Y.

Les Angeles : Mitsubishi International Corp., Los Angeles Branch, 606 South Hill St., Los Angeles 14, Calif.

Chicago: Chicago Representative of Mitsubishi International Corp., Room 1803, Prudential Bldg., 130 East Randolph Drive, Chicago, III. Vancouver: Mitsubishi Shoji Kaisha, Ltd., Vancouver Branch, 210 Toronto Dominion Bank Bldg., 717 West Pender St., Vancouver 1, B.C.

Lenden : Mitsubishi Shoji Kaisha, Ltd., London Branch, 104/106 Leadenhall St., London, E.C. 3

Paris : Paris Liaison Representative of Mitsubishi Shoji Kaisha, Ltd., c/o Mr. G. Bouvet, 5, Rue Boudreau, Paris 9 Duesseldorft Deutsche Mitsubishi Expo & Import-Gesellshaft m.b.H., Grunstrasse, Duesseldorf

Melbourne: Mitsubishi (Australia) Pt Ltd., Melbourne Office, 1st Flo Houghton House, 543 Little Collins S Melbourne, C. 1, Victoria

and combined machines

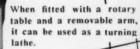
Universal head: Can be placed at any angle.

Milling can be done on three faces by the three way head.



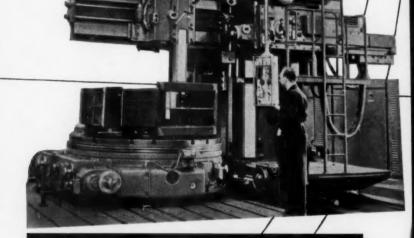


Right-angle head: Can be swivelled 360°.









MITSUBISH ZOSEN

Head Office: Marunouchi, Tokyo, Japan Machine Tool Manufacturing Division:

HIROSHIMA PRECISION MACHINE WORKS

Hiroshima, Japan



excellent grip; super finished bores minimize tool wear; and blended radii prevent tool hang up. All standard sizes and lengths

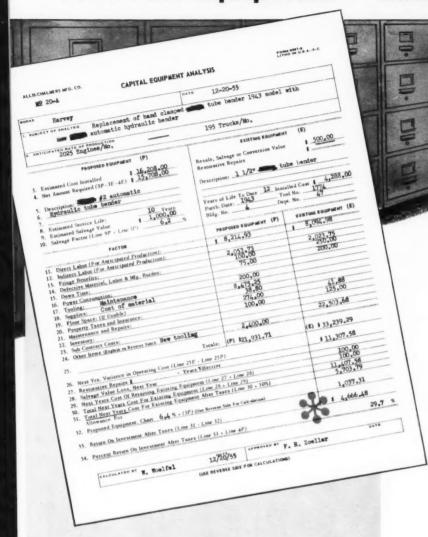


UNIVERSAL ENGINEERING COMPANY · FRANKENMUTH

MICHIGAN

219

FROM THE FILES OF ALLIS CHALMERS an equipment analysis form



GAIN FROM REPLACEMENT

by the Allis-Chalmers formula . . . after required interest or return on the new investment . . . after full allowance by the formula for future obsolescence of the New Equipment.

Allis-Chalmers has decided to make full use of the new MAPI approach and will apply it on new projects and expansions. At the same time, the company's experience with the standard or old type MAPI Analysis, for replacement only, has been satisfactory. Post audits have been in use for about four years and have proven our judgment correct.

The new one sheet capital
equipment analysis form
being used by Allis-Chalmers
retains the accuracy of the
old while providing added
flexibility. It permits expeditious
handling of all types of projects,
including replacements and
expansions. With it, capital
expenditures can be processed
and dovetailed into budgetary reports
enabling top management to select
those of the greatest merit.

T. D. Lyons, Comptroller Allis Chalmers Manufacturing Company

Keep gathering metal-working production ideas . . . be well informed when you replace machinery

Rockford Insert Group . .

January, 1961



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New from top to bottom . . . these machines incorporate every advanced feature gleaned from our 35 years of honing experience.

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CENTER OF MACHINE-TOOL EXCELLENCE ROCKFORD, ILLINOIS, U.S.A.



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COOPERATIVE TEAMWORK MAKES THE DIFFERENCE

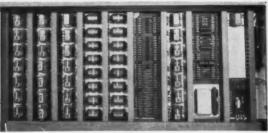
Through every phase of the construction of a Greenlee transfer machine, Greenlee engineers maintain a close contact with you, the customer. They are strong on the buyer's viewpoint . . . know what cost-conscious management wants. They stay on the job from the time of initial planning until your machine is operating at full efficiency. This last phase—the proving out period—is especially important. Greenlee men are extremely helpful in bringing your machine up to full production . . . training your operators to keep it producing profitably Call Greenlee. Let them show you how cooperative teamwork can benefit you.

GREENLEE BROS. & CO. 1943 MASON AVE. ROCKFORD, ILLINOIS

Machinery, January, 1961









The Tape-r-guide Lathe







Numerical Control with Simplicity through Incremental Tool Travel

As you have heard, there is the wonderful new world of numerical control: the world of

- profitable small-lot production
- reduced finished parts inventories
- · minimum tooling requirements
- maximum machine utilization
- · fast setup
- · quick job-to-job change-over
- · unerring mechanical control.

Now, add its capability for accurate part-to-part duplication, and you can begin to judge the depth of its influence.

If you're shopping numerical control lathes . . .

then it is to your advantage to know that you can gain all these benefits in a numerical control lathe that has a low initial cost, easy year-afteryear maintenance, simplicity of operation (and understanding), and gentle consideration of your valuable plant floor space. All this is yours in the new Barber-Colman Tape-r-guide. Why? Because of this thing called *incremental tool travel*.

Incremental tool travel is a Barber-Colman innovation in numerical control . . . a different approach to the tape-controlled lathe. To understand it, it's helpful first to consider the fundamentals of lathe operation.

A lathe does its work by holding a cutting tool against a rotating work-piece, feeding the tool in a longitudinal direction with respect to the axis of the workpiece, in a transverse direction, or in some combination of the two, to produce a desired contour. In a numerical control lathe, the operator has been largely replaced by nonhuman control. How, then, are these tool movements to be managed?

A choice of possible methods

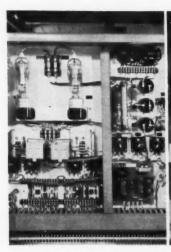
Tool movement along a given axis could be controlled by establishing a sort of electrical yardstick along which a tool could travel, reading voltage levels along the way to determine its stopping point. This frequently used system would require a second, guiding yardstick with a critical voltage at the stopping point. When the voltage reading at the tool matches the predetermined voltage level at the stopping point, an electrical null would occur, telling the tool that it had reached the mark. Overshooting or undershooting could be detected by the variation from the null, and corrections made accordingly.

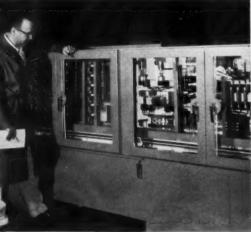
Such a system might require transducers to convert tool travel into corresponding electrical voltage which could supply feedback reading for making the comparison. Tool



Machinery, January, 1961

CENTER OF MACHINE-TOOL EXCELLENCE ROCKFORD, ILLINOIS, U.S.A.







$The \ Barber-Colman \ system \ selects \ precise \ travel \ movements$

thereby eliminating feedback reading equipment

(Continued from opposite page)

travel would have to be programed from a "zero point," the beginning of the electrical yardstick, or the lathe would not be oriented with the workpiece. This in turn would produce the need for a computer to make the tremendous multitude of calculations: every excursion of the tool would require a programing from the zero point for every distance traveled.

Tool positioning accuracy in such a system could be fantastically high. if the electronic components are properly tuned, because of the errorcorrecting function. Positioning to ten-thousandths of an inch might be feasible, although this is not to say that the finished work would be accurate to such a fine degree, as the lathe itself may not be sufficiently responsive, or sufficiently rigid, to carry out the precise control signals to the required extent. The question is, then, is all this equipment, and this high degree of precision, really necessary in an engine lathe?

The better way

Barber-Colman engineers didn't think so, and they set out to develop a numerical control engine lathe that would be as simple as possible, would have a minimum amount of auxiliary equipment, and would still do all the work that an engine lathe is expected to do within the usual engine lathe tolerances. They

started out, not taking an existing lathe and adding a control, but working out a system whereby the control would be built right into the machine, commencing with the controls that actually produce tool travel in lathes.

Working with these controls, they devised a method whereby given increments of travel could be produced in direct response to taped signals. They built a reliable system of clutches and differentials which makes possible the picking off of a variety of increments, increments that can be used singly or in combinations to cover any given distance with mechanical precision, arriving at any point within an accuracy of .001".

Their system involved no feedback reading, simply direct tool movement in response to the taped program. The movement of the tool is as direct and positive as the movement of one carriage space that results from one tap on a typewriter space bar. And it turned out to be a highly flexible system, also. By programing different increments of travel simultaneously on both the longitudinal and transverse axes, 700 different tapers can be cut, tapers that are smooth and step-free. It is also practical to program simple radii, chamfers and similar forms. Operations of this sort can be precalculated, then dropped in as appropriate in the form of subroutines.

Such a timesaving procedure is possible only in a system which is not tied to a fixed zero point. Systems which do have such a zero point must substitute a computer for a set of subroutines, since every point on a form (such as a radius) must be related to the zero point.

So, the new Tape-r-guide lathe emerges as a simple, closely integrated, computerless machine, having no separate consoles, no involved electronics. It has no need for memory circuits, since any memory function that is required can be coded right on the tape . . . the least expensive place to put it!

It is a machine that gives you only what you really need to capture the wonderful benefits of numerical control. For this reason, it is offered at a price that can put it in every progressive job shop.

Why not talk Tape-r-guide with your Barber-Colman representative—today?

Barber-Colman Company



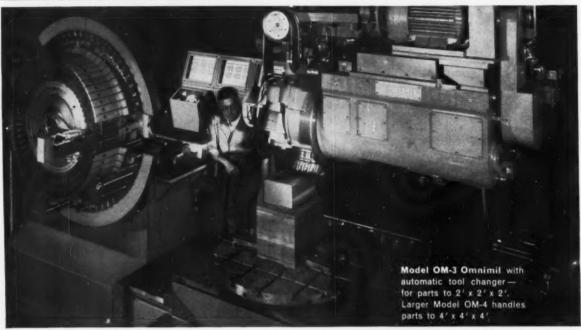
610 Loomis Street, Rockford, III.

Machinery, January, 1961



Sundstrand "Engineered Production" Methods

... practical ideas for men who are responsible for manufacturing quality, quantity and profit



aluminum housing milled, drilled, tapped, counter-bored in 1.86 hours in 3 setups on Omnimil vs. 12 hours with 29 setups on 29 machines by old method.



Savings - cast iron base drilled, tapped, bored, milled in 7.36 hours on Omnimil vs. 20.4 hours by old method.

Savings cast iron feed box bored, drilled, tapped, reamed. counterbored, milled in 6 hours on Omnimil vs. 32 hours by old method.



Numerically Controlled Omnimil is a single machine "production-line"

Mills, drills, bores, reams, taps at any angle to exposed faces of workpiece

You can handle on a single Sundstrand 5-axis Omnimil a variety of operations now requiring a battery of different machines. Many parts can be completed in a single setup on this extremely versatile multipurpose machine tool. Machining can be performed at virtually any compound angle and holes can be drilled, tapped, or bored square in respect to any angular face. Setup, work handling, and production time on many parts are cut as much as 10 to 1 and more over other methods.

All machine functions, including the optional automatic tool changer available on the Model OM-3, are under numerical control positioning or contouring. Maximum savings are effected on short-run production because of ease of change-over. Jigs are eliminated because the machine automatically positions to ±.001" accuracy.

The Omnimil is part of a complete system of standard and special Sundstrand numerically controlled machines designed to suit your production requirements. For details, ask for Bulletin 623-NC.





















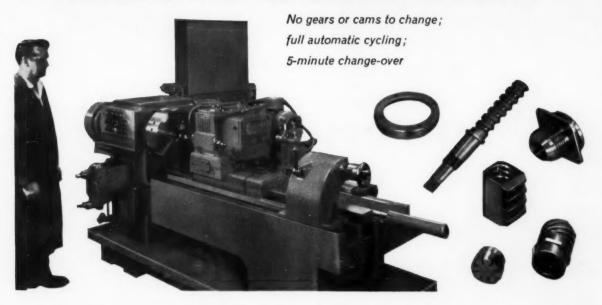








New thread milling machine dial-adjustable for leads up to 1/2"



The Sundstrand universal automatic thread milling machine with sine bar adjustment speeds work, improves accuracies, reduces scrap loss on a wide range of threading operations — including those difficult, costly, or impractical by other methods. It mills internal or external threads, right or left hand, straight, tapered, or special, with an infinite range of leads from 0 to ½".

The machine uses multiple thread cutters with no lead but with the desired pitch and thread form. The sine bar mechanism traverses the cutter to produce the lead.

No special operator skills are required to produce precision work. Fast 5-minute setup makes the machine ideal for short or long runs.

Four models handle workpiece lengths up to 24", 48", 72", and 96". Optional accessories include: taper cutting attachment; facing attachment; power positioning of cutter head; tailstock; steady rest for 1" to 6" diameter parts. Ask for Bulletin 623-TM for complete information.

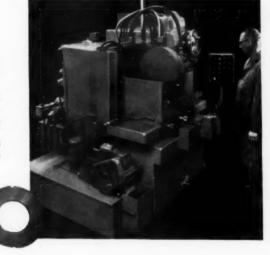
Hydraulic rotary surface grinder has easy-to-reach controls for fast operation

Heavy cuts and precision finishing made possible by rigid design

Completely automatic cycling, plus conveniently grouped controls, make it easy for the operator of a Sundstrand-Arter Model E rotary surface grinder to produce error-free work at high production rates.

The extremely rigid, precision design of the machine enables it to take heavy stock removal cuts, as well as to produce extremely fine finishes to close tolerances. For example, the clutch plates illustrated are ruff and finish ground to a flatness of .001" total indicator reading with .005" repeatability. Production is 45 sides per hour, at 85% efficiency. Stock removal is from .009" to .012".

Two models are standard with nominal chuck diameters of 12" and 16". A Sundstrand Power-Grip magnetic rotary chuck is standard equipment. Ask for Bulletin 623-G for specifications and details.





SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS . DIVISION OF SUNDSTRAND CORPORATION

Machinery, January, 1961



You can't afford not to know what's new for you in Mattison high-powered surface grinding

These three new "Mattisons" do more and better than conventional grinders in their class. How much more for your profits and how much better for quality, nobody knows. But we know this. If you have any appreciable volume of flat machining—milling, grinding, or even planing—you'll want to buy a new Mattison soon. Here's why.

The new No. 60 and improved No. 24 increase production over conventional grinders by 50%, or more. Reason is Mattison's new concept—power spindle tilting. This, plus ability to use 40 to 150 hp motors, makes them most economical for stock removal . . . as well as for fine finishing. Investigate these and other features, such as continuous downfeed, automatic gaging, and box-type construction.

For precision grinding of large parts, consider our new horizontal line. Productivity, accuracy, and finish capabilities all have been improved. Electronically controlled cross feed, improved hydraulics, power assist table positioning, and optional automatic downfeed are a few of the standout features. Get all of the details from your Mattison dealer.

MATTISON MACHINE WORKS

545 Blackhawk Park Avenue, Rockford, Illinois . Phone WO 2-5521

If it's a flat surface, there's a Mattison to grind it



MATTISON



Machinery, January, 1961

Steel that gives cycles



stronger heart

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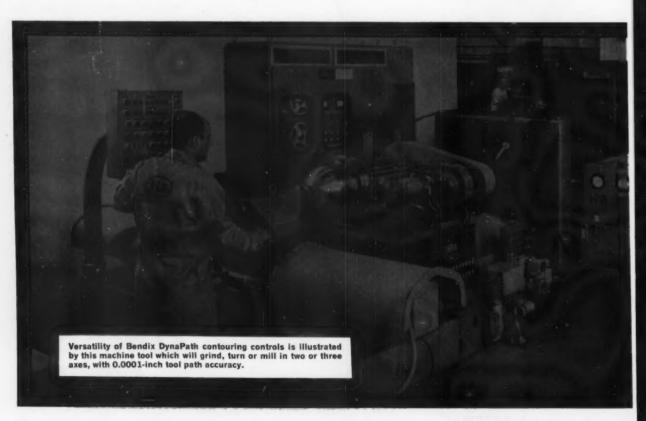
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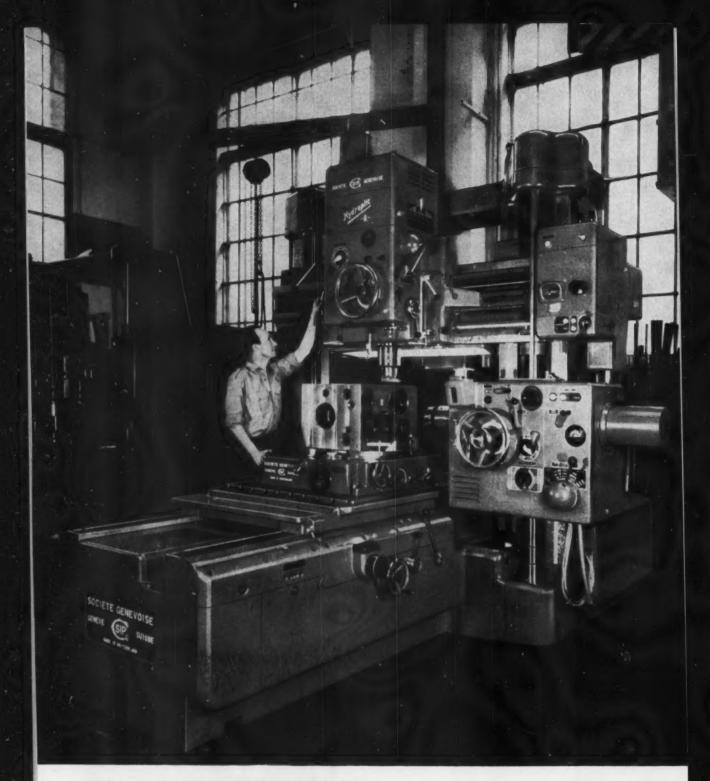
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- Normalizing Not Enough
- Soviet Progress Discussed
- Citizenship Action Aircade Planned
- Washington Briefs



Keeping up with Washington

Loring F. Overman

WITH A NEW ADMINISTRATION taking over in Washington, and with the subject of comparative rates of economic growth still attracting attention, the role of machinery and allied products becomes of increasing importance.

"Sixty Years of Business Capital Formation" is "must" reading for all members of the new Congress as well as for others who should be informed on the subject. A new study over the signature of George Terborgh, it is one of a long list of titles published by the Machinery and Allied Products Institute "in the hope that they will make a contribution to a sound program of tax reform, particularly in the areas of corporate rate and depreciation policy."

Normalizing Not Enough

The MAPI pamphlet introduces a new term, "normalization." By this is meant the need to restore a normal relation, both qualitative and quantitative, between capital goods and contemporary economic activity—actual activity, not what it would have been without the misfortunes of 1930 to 1945. The study then points out that the apparent near-normalization of the quality and quantity of the capital goods stock does not imply that the present situation is satisfactory or that current levels of capital expenditures are adequate. Two important considerations, the study continues, argue to the contrary: the impending increase in the growth rate of the labor force, and the intensive competition of the Soviet Union. Both considerations argue for higher ratios of capital formation to national product.

Soviet Progress Discussed

The MAPI study repeats a statement made before the Ways and Means Committee of the House of Representatives: "We are in competition, militarily and economically, with a country that has sustained in recent years, and seems likely to sustain for some time ahead, a growth rate approximately twice our own. It is obvious what this means for our prestige before the world. If the Soviet Union can manage to outpace us so dramatically for another decade, it will be hard to convince even our friends that the Communist economic system is not the wave of the future. Neither is it necessary to stress the implications of this situation regarding our ability to compete with the Soviets in military and related expenditures. If they continue to gain on us in production, this competition will become progressively easier for them and harder for us."

Capital Equipment the Key

Mr. Terborgh concludes by observing that "probably the most important reason for the difference in growth

rate lies in the fact that the Soviets devote a far higher proportion to productive capital formation than we do. Again, the moral for us is obvious: The past is not good enough. We need new norms for productive investment.

"Here is a challenge to the public policy of the future, above all, to tax policy. For if we are right that the enlargement of business investment depends primarily on an increased flow of funds available for the purpose, there is an evident need of tax reform to encourage saving and capital accumulation. This is the surest way to attain a higher rate of economic growth."

The pamphlet is available at \$1.50 per copy from the Machinery and Allied Products Institute, 1200 Eighteenth St., N. W., Washington 6, D. C.

Citizenship Action Aircade Planned

Observing that the new Congress will welcome viewpoints from constituents in the business community, the United States Chamber of Commerce is planning a series of Citizenship Action Aircades between February 27 and March 16. Business leaders and C of C specialists will fly to key cities for panel discussions of major legislative issues affecting businessmen.

The invitation to attend points out that the new Congress will consider such subjects as a higher minimum wage, compulsory medical care, school construction, tax reform, and secondary boycotts. Cities on the aircade itinerary are Worcester, Pittsburgh, Detroit, Birmingham, Tulsa, Omaha, Denver, Hollywood, Oakland, Spokane, Anchorage, and Honolulu. Slide-film presentations will be available through local chambers of commerce for showing in other cities.

Washington Briefs

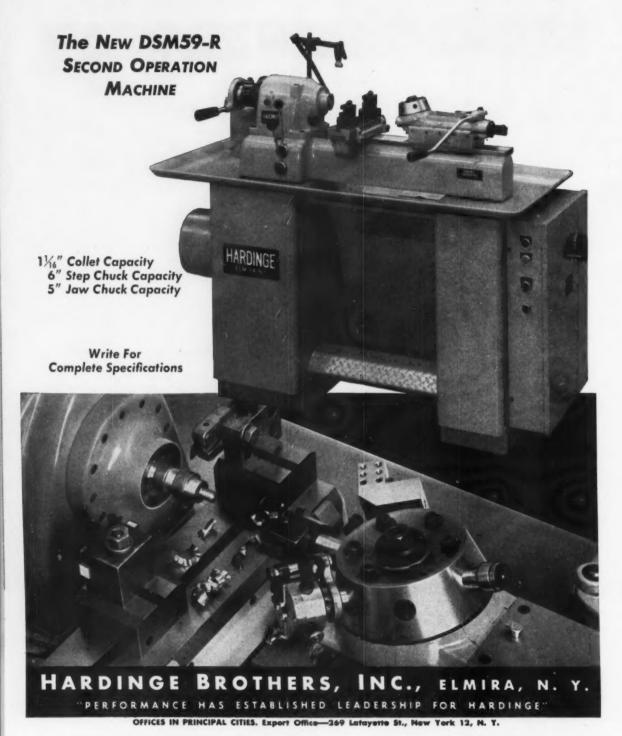
The Machinery and Allied Products Institute has been asked by the Defense Department to review a proposed revision of the department's policy on the acquisition of contractors' technical data. MAPI is one of a half-dozen industry groups invited to participate in the discussions, a prelude to new regulations to be issued early in 1961. The discussions seek clarification of patent rights under development contracts.

Use of fewer machining operations are goals of two new Air Force metallurgical reports released through the Office of Technical Services of the Department of Commerce. The reports state that high-strength steel forgings for high-performance aircraft and missiles can now be made quickly and economically with a minimum of machining operations.

The National Machine Tool Builders' Association is continuing to act as liaison agent between industry, government, and user groups developing machine tool standards. Rapid progress is reported, particularly in the Milling Machine Division.



Hardinge Machines Are Essential in the Production of Super Precision Second Operation Work



Better Quality Control Permits Extended Automobile Warranties



MANUFACTURING'S OBJECTIVE for the 1960's, particularly so far as the automobile industry is concerned, is greater product reliability. The warranty on automobiles to the public is now good for twelve months or 12,000 miles instead of the ninety-day or 4000-mile limit that was in effect for a long time. In the case of one high-priced car, the warranty is now twenty-four months or 24,000 miles.

The industry maintains that these warranties are now possible because of new concepts of quality control. Automobile builders are following the pioneering efforts of the missile builders who developed reliability programs that have eliminated mechanical failures of their products.

How the Ford Motor Co. has applied new ideas of quality control throughout its manufacturing and assembly plants is comprehensively described in the leading article of this issue of Machinery. The principles and methods described should be of considerable value to many plants of the metalworking industry that want to strive toward eliminating "bugs" in their products before they reach the market.

Adoption of reliability programs necessitates the use of manufacturing equipment that will produce to close dimensional tolerances with constant uniformity. In many cases, it will mean the installation of modern machine tools and other equipment that is up-to-date. Improved inspection equipment will be essential. Intensified supervision will also be a necessity.

Reliability engineering and efficient quality control have proved their effectiveness and are certain to receive increasing attention in the coming years. They are a means of insuring that the ideas of the designers actually culminate in the finished product.

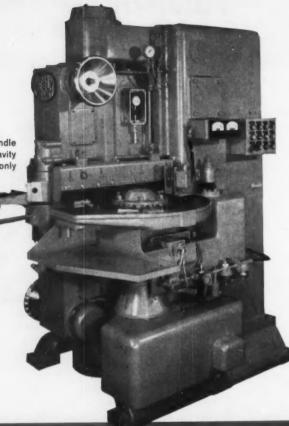
Charles O. Herb

EDITOR

Besly DV2 Double Vertical Spindle Disc Grinder with automatic gravity feed and discharge. Requires only 8-ft. by 8-ft. floor space.

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The DV2 will grind parts that range from

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The QUALITY CONTROL Program behind Ford's extended warranties for 1961

LAURENCE W. COLLINS, Jr., Associate Editor

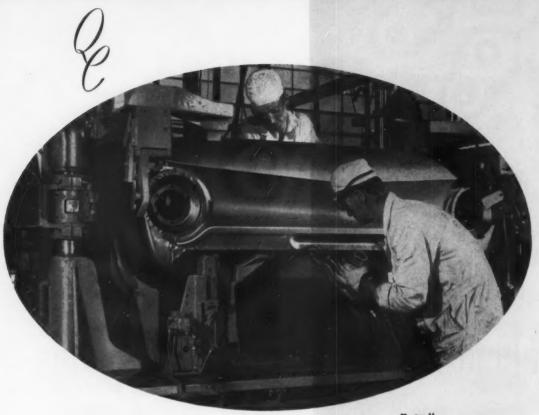
Increased value in automobiles results in greater sales. The way to increase value is by improving quality. Ford's advanced quality control is a broad-gaged system that assures quality in the product. The company has emphasized in-process inspection and supplier quality assurance. The result: savings

A DVERTISING for 1961 Ford-built cars runs the slogan: "Beautifully designed to take care of itself." To bear out this claim, the cars are stated to require a change of crankcase oil only once in 4000 miles and need chassis lubrication only

once in 30,000 miles. Further, the warranty to the public has been stretched to one year or 12,000 miles, whichever comes first, on all cars except the Lincoln Continental, which is two years or 24,000 miles.

To the average car buyer these new guarantees are attractive because they represent new value and promise him that he won't be "stuck with a lemon." To the more technically minded, the new warranties suggest the possibility that Ford must have gone part way toward solving a quality-control problem that has dogged the automotive industry since it began.

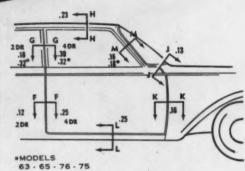
There is no doubt that every auto builder has tried to produce cars that would give owner satisfaction. However, it is also true that over the



Trainees are shown welding the floor pan to the body of a pilot model in a huge fixture prior to painting and installation of trim hardware, moldings, glass, and wiring.

years certain models turned in better performance records than others. Certain engines were better than others, certain models gave less trouble in their steering gear, differential, transmission, oil consumption, door fits, paint, upholstery, or other areas. Some models were economical to run, had good riding qualities, and had good chromium plate on bumpers and trim, while others left much to be desired in the quality of the product.

John Dykstra, vice-president, manufacturing, of the Ford Motor Co., along with many others in automotive management, has long held the view that "you must design and build quality into a product." Mr. Dykstra, and probably others, was troubled by the problem of how to "get car value off the designers' drawing boards and into the customer's garage." He reasoned that if the design of a car is good, and the production equipment is properly tooled, good parts will be produced. Good parts, properly assembled, should result in cars, each of which should run many thousands of trouble-free miles. But somewhere in this scheme of things there always were manufacturing lapses or gaps that were the source of



Handbook contains sketches and instructions covering all changes for all the cars of a new year's models. This sketch shows front-door final fitting tolerances for 1961 Ford and Mercury two-doors.

failure. Obviously, when this happened there were too many rejects "getting out."

Mr. Dykstra noted the similarity between this problem and the problem missile builders were trying to solve in order to get their "birds" to fly to the target every time. The missile builders were using a new quality-control concept in trying to drive the mechanical failures out of their products. It was called reliability engineering. A good simple definition for reliability engineering is "debugging" in advance. The natural result of getting all the weaknesses out of a product would be "designed-in" quality.

The 1961 models mark a value plateau reached by Ford with its company-wide quality-control program. The groundwork underlying the extended warranties was started many years ago. Ford realized that it needed a standard method of measuring quality which could be applied across the country to all its cars and trucks. The method had to be accurate, uniform, and reasonably simple. "All vehicles, subassemblies, parts and materials must meet engineering specifications in all respects to be approved for further processing, use or shipment." This, in a nutshell, is Ford's quality concept. The system provides a means of identifying defects and tracing them directly to their source, quickly, for immediate correction.

At each assembly and manufacturing plant, quality control inspects products at stations located throughout the various production areas. Only units that meet engineering specifications are approved to move onward for further processing. Defective units must be reworked and reinspected to assure that they meet specification before being approved for use or shipment.

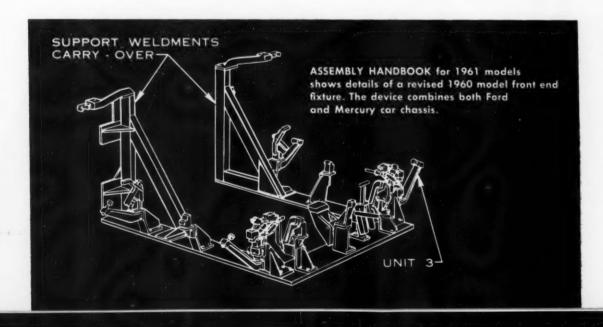
In assembly plants the quality-inspection program requires a visual, gage, or functional test of over 1500 separate items on a car. Periodically quality engineers and technicians from the general offices in Dearborn make visits to each assembly plant to examine the cars and trucks that the plant's inspectors have checked. If the examinations by the Dearborn quality-control engineers and technicians agree with those of the plant, it can be assumed that plant production and inspection are functioning to give management a true control and measure of quality. When the reports are at variance, investigative and corrective action is begun immediately. Constant vigilance and training are necessary by all parties. The benefit of the quality-control system is that

by inspecting a statistically valid sample of total production, headquarters can evaluate daily the quality of over-all production at each assembly plant. Herein is the essence of managed quality control.

Behind the Ford quality-control system at the assembly plants is a far greater and more penetrating effort to improve component and subassembly reliability and quality through the company's quality-control center. Here the system closely parallels missile reliability engineering systems. Ford's quality-control center is unified for all vehicles except Lincoln and Thunderbird, each of which is built in a single plant and is therefore presently considered sufficiently integrated to manage its own quality control.

However, for all other cars and trucks, which are built in sixteen other assembly plants located throughout the U.S.A., the quality-control center functions on an integrated basis in its own building near the Ford Motor Co.'s Dearborn headquarters. This quality-control center has complete pilot-line facilities for testing parts and for assembling a car or truck in the Ford, Mercury, Falcon, Comet, or Meteor lines. During 1960 the center reviewed and evaluated the preproduction design specifications of about 19,000 components, subassemblies, and assemblies for future models, maintaining close liaison with the product engineering department so as to assure that these specifications would meet quality objectives. This operation is also designed to uncover production problems before mass production begins.

The pilot assembly line, a duplicate in every essential of the lines in Ford's assembly plants, was first used to pretest 1959 cars and light trucks. Literally hundreds of potential problems were exposed that otherwise would have remained hidden until mass production began in the assembly plants.





Question-and-answer periods at Ford's Quality Control Center give visiting assembly-plant key personnel every opportunity to thoroughly understand new model changes.

Not only are assembly problems studied and solved, but every individual component of the test and pilot vehicles is inspected and verified to meet all engineering specifications. All suppliers, whether inside the company or outside, must submit to the center production-run samples of the parts they will be making, months before quantity delivery of a new model begins. When discrepancies are found, corrective measures begin at once. Specifications needing re-examination or re-evaluation are studied at meetings with the product engineering department. Changes are made when necessary. Thus, many potential problems are solved before they materialize in the various plants making or assembling the components.

After the work on preproduction models is completed and every precaution is taken to insure

that the product package, properly processed, will retain the level of quality planned for it, the responsibility for launching the production of a new model moves to the various manufacturing and assembly divisions of the company. How this responsibility moves from the division general offices to the assembly plants is a second story.

While the assembly plants have been concerning themselves with building the current models to meet engineering specifications in every detail, the division offices, product engineering, manufacturing engineering, quality control, and plant operations are finalizing processes, tooling, equipment, fixtures, gaging inspection procedures, and transport that will be used to produce the next year's models.

Early in April their collective efforts near completion. The next step is to communicate to key







Body-gage master is first proved on advance prototype testing. Later this gage serves as master for assembly-gage prototypes.

assembly-plant personnel the thousands of details involved in building upcoming models. The department best suited to carry out this exchange of information and investment of responsibility is the quality-control center. Not only is it intentionally equipped for such an effort, but it is also ideally located. Beginning with plant managers, assistant plant managers, quality-control managers, and planning and engineering managers, the convocation into Dearborn begins in the spring of the year.

Four months later, after hundreds of training conferences, over four hundred key assembly-plant men have received and learned the details of their responsibility for building and inspecting the new models. In groups of forty to eighty men, they arrive and hear their segment of the total story during their stay in Dearborn. They depart with armfuls of engineering drawings, process sheets, presentation booklets, "Here's How" manuals, and other aids to use in training their own plant personnel when they return home.

In the pilot-plant area of the quality-control center, each man has seen and tried for himself each new assembly process he will supervise. He has seen and tried the new tooling, fixtures, and gages his people will use months later when the new model is launched. He has heard directly from the process engineer who established the procedure the specific details that must be care-

fully watched to insure that the end product will meet engineering specifications. He has heard from the man who made the selection why a given tool, piece of equipment or machinery, or welding gun was selected over another kind. Thus every trainee from body shop foreman to assistant plant manager has a chance to try his hand at his specialty, whether it be trim, painting, welding, engine drop, gaging, or other functions in the assembly process, with the work being done on the pilot assembly line.

Following each of the dozen or more pilotplant training sessions and demonstrations, the group gathers in the main conference room for critique sessions. Here each trainee has a chance to ask questions and to exchange comments with other trainees or make suggestions about a given process or tooling setup.

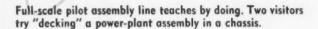
Such critiques, where "assembly-plant experience speaks and is heard," are the highlights of the training conferences. In these critiques, the "planners" and the "doers" share and exchange viewpoints and ideas. No suggestions from the "voice of experience" are ignored. If the suggestion offers a better assembly method, an improved tooling change, or a relocation of an assembly station, it is restudied by the responsible process engineer and, where meritorious, incorporated in the final process sheets.

Obviously these training conferences are ex-



Ford's Quality Control Center has a full-scale merry-go-round welding fixture where assembly-plant training group instructors can practice with new assemblies.





pensive and time consuming. However, the company feels that the benefits more than offset the costs by the improvement of morale and the production of consistently better and better vehicles. Model change-overs are accomplished more rapidly and efficiently. Savings are realized because assembly problems are caught before they occur in the widely separated assembly plants.

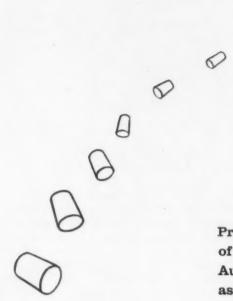
There are other benefits. Because of the closer rapport between assembly-plant personnel and Dearborn headquarters personnel, the plants all work with greater enthusiasm and confidence. They know the "why" and "how" of many details they formerly had to accept without question. Through active participation, they feel closer kinship to headquarters personnel because they know headquarters knows them and their problems. Morale always improves when a work force knows the whole organization is constantly striving for the improvement of quality and at the same time knows "top management" is really behind them in making an all-out effort along a broad front. Through participation the divisions know that the quality-control effort is more than just a lot of talk.

Proof that assembly-plant personnel both profit and approve of the training methods used for launching new models was evident in a survey taken two months after the 1961 model change-over training sessions. From foreman to assistant plant manager, 97 per cent approved the "Here's How" program (as it is referred to in the several divisions) and voiced their desire that it continue. Already Ford headquarters personnel are well down the road to planning the processing and assembly of the 1962 models. In the spring of 1961 the "trip to Dearborn" will be eagerly anticipated by hundreds of assembly-plant personnel at the sixteen plants.

Again the information they are going to receive on the upcoming models will be the result of cooperative and coordinated efforts of headquarters office personnel. Working hand in hand at the quality-control center, Ford division headquarters offices such as manufacturing engineering, product engineering and quality control will determine the many details of design, assembly, and inspection that will be used in the '62 models. An example of 1961 model preproduction decisions was determining whether the welding of certain body panels should be performed at the stamping plant or at the various assembly plants. From one standpoint it might appear that welding of the panel should be concentrated at the stamping plant because one merry-go-round fixture could do the job for all sixteen assembly plants (instead of having a separate merry-go-round in each plant). However, when the problem had been carefully studied, it was decided to build the sixteen fixtures. The reason? Shipped disassembled, the parts nested together in freight cars to give a much more favorable shipping cost. In addition, panels welded at the assembly plants would be of better quality because they would not so likely be damaged in transit.

Managed manufacturing and assembly, as it is developing at Ford under reliability principles, seems destined to become a powerful influence in the industry. It effectively improves quality without raising prices by eliminating rejects and backtracking, and by its ability to simplify model change-overs. Centralized under one roof, the quality-control center and the concept it represents has already produced an extremely desirable effect on the product by drastically reducing the number of assembly-plant rejects and rework time, an important source of savings.

(Continued on page 123)

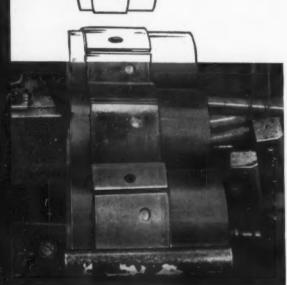


Progress in the design and manufacture of starter motors and generators enables Autolite to go from coil stock to frame assemblies in

ONE CONTINUOUS LINE

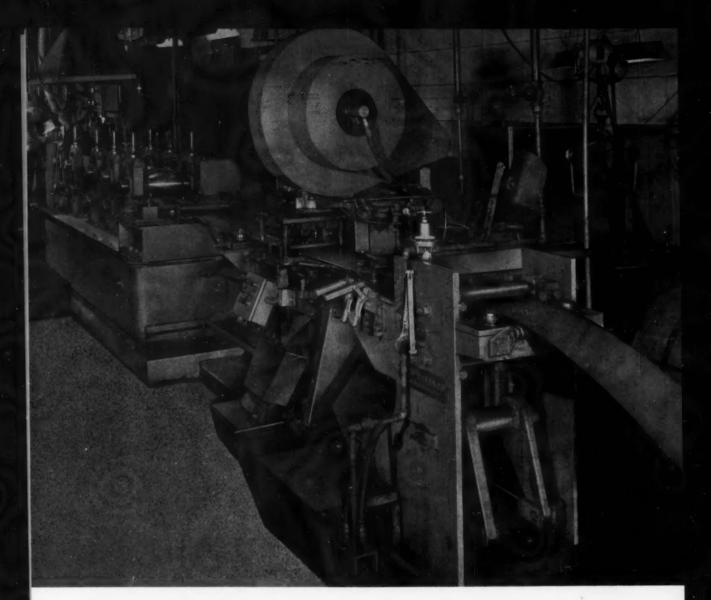
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RAYMOND H. SPIOTTA Associate Editor



An advanced over-all design of generators and starter motors—and of their frames in particular—has given the Electric Autolite Co., Toledo, Ohio, the opportunity of leaving standard (and comparatively slow) production methods by the way-side. In place of banks of presses shaping one heavy-walled frame at a time is a newly installed automated frame line. This continuous line accepts coils of flat stock at one end and delivers completed frame assemblies at the other.

Multiple-piece frames are, themselves, an innovation. The new Autolite frame consists of a light-gage inner member of standard length and diameter and of adequate strength to support and align the end heads, and a heavier-gage, but narrow, sleeve that is pressed over it. The advantages of this design are threefold. First, it yields



lighter-weight starter motors and generators; second, it concentrates the metal where needed, in the field coil area for an improved magnetic flux path; third, and aside from the obvious economic aspect, the comparatively thin material used for the main, or inner, frame member holds manufacturing problems to a minimum.

Main Line Supplies Rough Inner Frames

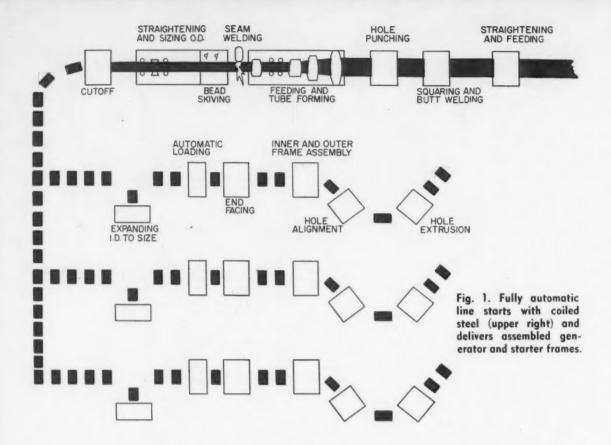
There are two basic sections to the automatic line. The first, or main, section is basically a continuous Yoder rolling mill with special equipment added. It ends with the supplying of rough inner frames. The second section starts with these and ends with completed frames consisting of both inner and outer members. To balance flow rates between the two sections, the latter has three identical lines, Fig. 1.

When generator frames are being run, coils of

0.125-inch thick mild steel, 12 5/8 inches wide, are placed in a cradle at the head of the line. Either hot- or cold-rolled steel can be used, although hot-rolled is preferred. The cradle accommodates two coils, one active and one in reserve.

Straightening rolls work the material before delivering it to a squaring unit (right, heading illustration). It is here that the rear end of one roll is joined to the front end of the new roll to avoid interrupting the train of metal being fed along the line. A shear blade in the unit squares off the ends of both strips, after which they are butted together, locked in place by cross-bars and toggle clamps, and hand arc-welded. The bead is ground flush and feeding continuous, approximately seven minutes being all that is lost.

Because the cylindrical frames start out as flat material, it is possible to punch all required openings before the forming is begun. This is done at the next position, Fig. 2. Here, seven holes and two locating slots are punched through the metal



by a flying die. With the die in the position shown, a pawl in housing A drops into a locating slot punched in the previous strike, thus locking the die to the metal strip. Determining the proper size and location of the holes was one of the major developing phases of this program.

Continued travel of the strip pulls the die to the left until a limit switch B is released, at which point the press is tripped. If, for any reason, this fails to occur, a die protrusion will strike limit switch C and the entire line will shut down. When the die closes, the pawl is caused to pivot upward, disengaging the strip and riding along its surface until it drops into the next locating slot. As the punches clear the work, heavy springs return the die to its starting position.

To minimize the number of dies necessary to handle the various styles of Autolite frames, several of the punches are eccentrically mounted. In this way, hole spacing of any particular die can be varied within a certain range.

Pairs of centering rollers guide the punched strip as it enters the main bank of Yoder forming rolls. There are ten sets of rollers in this bank, Fig. 3—some mounted horizontally, some vertically. Between the two rolling stands at the right, the metal strip can be seen undergoing initial forming as the two sides begin to fold upward, at D and E, to a concave cross section.

Tubular configuration is more noticeable as the edges begin to close between two pairs of vertical rollers at F. This can be seen more clearly in Fig. 4. After the stand shown at the left there is one more pair of vertical rollers and one more stand of horizontal rollers that complete the tubular shape in preparation for seam welding.

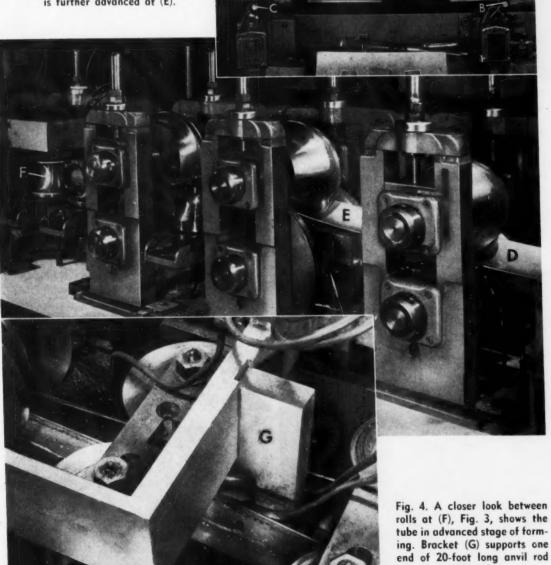
In the welding area of the main section of the frame line the tube passes between two more vertically mounted rollers, Fig. 5, which support the sides of the tube while assuring proper joint clearance for the continuous weld. Coated electrode wire is fed from a spool through a Lincoln welding head. Current used is approximately 850 amperes at 23 volts, although this is varied slightly from time to time to maintain consistent weld quality. The tube is grounded by a laminated copper shoe that contacts the work from below.

There are two elements that warrant attention at this point. First, the arc must not be permitted to burn through the tube wall which, due to the relative thinness of the metal, is a distinct possibility. Second, the weld bead must not be allowed to protrude beyond the inner surface of the tube.

Both of these conditions are adequately met by means of an internal anvil, or welding shoe. This copper anvil is held tightly against the inside of the joint by a heavy spring. Anvil and spring are, in turn, supported by a 20-foot long anvil rod ex-

Fig. 2. Flying die punches all required holes and locating slots for one inner frame at a time without interrupting the feed movement.

Fig. 3. Ten sets of rolls in this section form continuous tube from flat steel. Shape begins to change at (D), is further advanced at (E).



MACHINERY, January, 1961

within tube.



tending within the tube. Referring back to Fig. 4, the bracket supporting one end of the rod is seen at G. Also visible are two copper water tubes leading into the tube and thence to the welding anvil. Water cooling of the shoe is essential because of the great heat that is encountered directly beneath the arc.

Two internal rollers are mounted on the long rod just beyond the welding area to prevent distortion of the tube while the welded seam cools. A group of water jets playing against the seam



Fig. 5. Continuous seam welding of formed tube using coated electrode wire. Water-cooled copper shoe held against inside of seam prevents are burn-through.

accelerates the cooling process. At the end of the rod is a circular felt wiper sandwiched between two metal washers. Its purpose is to hold back any foreign matter or weld splatter that may have collected within the tube.

Immediately after the welding station are two formed, brazed-carbide skiving tools. They are mounted on individual, adjustable, overhead slides by means of which they can be raised or lowered as required. The first tool rough-cuts the weld bead while it is still at a red heat. Just behind this, the second tool finish-cuts the remaining raised portion of the bead to bring it flush with the tube surface.

Once again the tube is straightened, this time by four sets of rolls. From these rolls the tube is cut off into individual frames in the operation shown in Fig. 6. The tube enters a cutoff die in a Johnson OBI press. In an operation similar to the one described at the beginning of the line a latch, or pawl, in the die engages one of the locating slots in the tube. By this means the die is forced to travel with the tube until the press is tripped and a guillotine blade H slices off an individual frame. As with the first press operation, a limit switch will shut down the entire line if the die should fail to disengage from the tube and be carried too far to the side.

On the exit side of the press the inner frames drop down a chute and end up on an inclined conveyor that raises them to a horizontal belt serving the three secondary sections of the automatic line.

It should be pointed out that the speed of this line is adjustable from the main console. Although this speed can be varied, best results so far have been obtained with the tube moving through the line at the rate of 10 fpm.

Secondary Lines Yield Assembled Frames

Still in an uninterrupted flow from the cutoff press, the inner frames are delivered to one of three secondary lines for further work. All three lines are identical—automatic gate deflectors direct "traffic" to those that are empty enough to accommodate additional parts.

The first stop as the frames roll down this final line is a sizing station. Here, the part is pushed from the line and slipped over a hydraulic ex-

Fig. 6. Last step along tube-forming line. Guillotine blade (H) in a flying die slices tube into individual frame members. Chute (lower right) leads to secondary lines.

Fig. 7. Automatic lathe faces and chamfers both ends of inner frame simultaneously, bringing it to correct over-all length. Line of outer frames is overhead.

panding mandrel which is promptly activated. This step is important, as the size and shape of the frame interior must be closely held to insure the existence of a proper air gap between the field coils and the armature.

In addition to sizing, a second purpose is served. Sufficient expansive force is exerted against the inner frame to check the quality of the seam weld. Should it be below an acceptable

level, the seam will split open.

For a final machining operation the inner frames roll down an inclined chute (after being automatically ejected from the sizing mandrel) to a loading location J in front of a No. 6A Sundstrand automatic lathe, Fig. 7. When a part is to be transferred to the lathe, pivoting arm K lifts the first frame from the chute and snaps it in place between loading fingers L of an overhead shuttle arm. It is interesting to note that as arm K swings upward a motor is energized which causes the frame to rotate slowly. This is to orient the parts so that, when carried to the lathe mandrel, they will always be located from the same low point on the sheared face. The low point is actually the base of a locating slot that was cut in half by the guillotine blade at the end of the tube line.

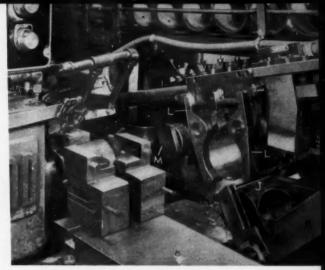
When the loading fingers deliver a part to the work area, a tailstock plunger *M* pushes it from between the fingers and onto the mandrel. Two cutters on the cross-slide feed in, straddling the part, to face and chamfer both ends of the frame at the same time.

As the tools retract, the inner frame is slipped off the mandrel and dropped behind the lathe into a chute leading to the last automatic unit in the line, a Grotnes assembly machine. Here, Fig. 8, the inner and outer frames meet and are joined to form the frame assembly.

The inner frames arrive from the automatic lathe in the chute N at the right. Narrow, split outer frames arrive in an inclined chute O at the left. The elevated line leads directly from the press that punches and forms the outer member and can be seen running above the inner-frame line along the top in Fig. 7.

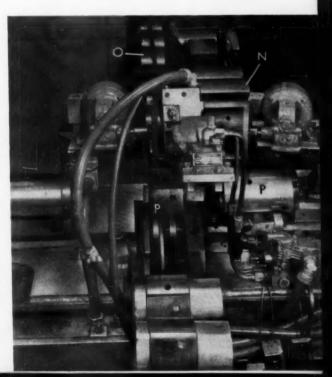
One of each frame member at a time is allowed to roll to the preassembly position *P*, Fig. 8. While there, they are rotated for proper orientation in relation to each other—the outer frame is located

Fig. 8. This automatic machine orients and assembles outer frames (O) to inner frames (N). Completed assemblies (foreground) are ready to receive pole pieces.



from a hole, the inner frame from a notch. The assembly operation, itself, is simple. Two Hannifin air cylinders press the two members together. Because the outer frame has an open seam, it acts like a snap-ring during assembly and eliminates the need for having a close-tolerance fit between the members. Assembled frames can be seen in the foreground.

Each assembly is then placed manually on a small press where a drift pin aligns corresponding holes in both members. On a second small press, metal from the wall of the inner frame is extruded outward and into a hole in the outer frame (in one spot only). This is to prevent movement between the two parts until the pole pieces are added inside the frame. When they are added, screws pass through both the outer and inner frame members and into the pole pieces, locking the entire unit together.



45,000,000 WATTS

FABRICATE CHRYSLER FLOOR PANS

Along what is said to be the largest automatic resistance-welding line in the automotive industry, rear floor pans for almost all the corporation's cars are fabricated at the rate of 2000 each shift. Titanic electrical appetite of this installation is spoon-fed under the constant supervision of an electronic scanning pulse that travels from one machine to another in but 120 millionths of a second

RAYMOND H. SPIOTTA
Associate Editor

R ESISTANCE WELDING of floor-pan assemblies is, in itself, commonplace. When a bank of several press welders is tied together by automation, a degree of interest is aroused. But when twenty-four press welders consuming 45,000,000 watts—the equivalent of 60,000 hp—and occupying an area approximately equal to that of three football fields are so linked, further information certainly is in order.

Actually, the installation at Chrysler's stamping plant in Twinsburg, Ohio, consists of two identical 658-foot long lines, one of which is shown in Fig. 1. One line is usually engaged in production of floor-pan assemblies for 118-inch wheel-base cars while the other line produces assemblies for 122- and 126-inch wheel-base cars.

A total of eighty welding operations are performed on machines ranging in size from 100 kva up to 2400 kva. Stamped sheet-metal members are welded back to back to form outer rails on a group of fourteen small, independent press welders just ahead of the main line. Seven of these are in one line for left-hand rails, and the other seven in a second line for right-hand rails. At the main transfer line these rails become a ladder assembly.

On a branch line, center and rear floor pans are welded together before being introduced to the main line and meeting up with the ladder assemblies. The ladders and the pan are carried on large shuttles from one machine to another while various structural cross-members are added and welded in place. As each shuttle arrives at a press welder the part is raised to meet the overhead electrodes. Electronic timers supervise every move of the welding process. One provides ample time for the metals to be squeezed together before the current is applied. Another maintains pressure on the parts until the molten metal has solidified.

Sixteen months elapsed from the time the design of this line was initiated until installation was completed. Chrysler worked closely with the Resistance Welder Corporation through all phases of design and construction. Because of its flexibility the line can be set up to accommodate certain different assemblies in but twenty minutes. In the complicated switch from a floor-pan assembly for a 122-inch wheel-base station wagon to that for a 118-inch wheel-base sedan, for

example, sections of individual welding fixtures need only be cranked to the required locations. This switch requires six hours.

Electronic Scanner Controls Functioning of Welding Line

An electronic scanning pulse that travels from one machine to the next at a speed of 120 millionths of a second masterminds all the resistance-welding operations. Thought to be the only one of its kind in existence, the scanner automatically searches, controls, and times each operation to make sure all weldments are solid, fused units.

Twenty-four main press welders are scanned at the rate of 320 times every second to determine whether each machine is ready to weld. When a go-ahead signal is received, the electronic brain permits individual firing of all the units at extremely short intervals. It is in this way that more than 860 spot welds are created to form the rail and floor-pan assembly for almost all of the corporation's cars.

This electronic brain—sometimes termed a Magic Wand—is a necessary adjunct to the automated assembly line because of the large amount of electric power consumed. (Heart of the electronic brain, manufactured by the Instrument Control Co., Minneapolis, is a group of cascaded Burroughs beam-scanning tubes.) Were two of the giant press welders to be fired simultaneously, weld quality would be seriously affected due to excessive voltage drop. Electrical feeding of the units is, therefore, controlled in millisecond intervals so that no two will fire at the same time.

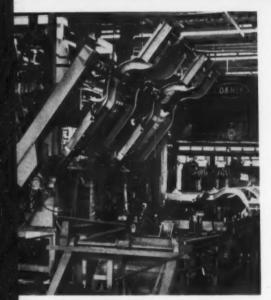
It is inherent in an automated assembly line that certain machines react more quickly than others. Should a given machine fail to fire within three seconds after being directed to do so, the scanner will note it, illuminate a red warning light, then proceed to scan the other machines in the line. If the electronic brain fails to function, an identical interlocking scanner alongside it can be placed in operation within fifteen seconds.

Ladder Assemblies Take Shape First

Each rail of the basic ladder assembly (bottom, Fig. 11) is made up of two formed sheet-steel members welded back to back with three







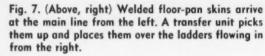


Fig. 8. (Above, left) After the skin and ladder are married (Fig. 7), four more stops and 370 spot welds complete the assembly. Here, one floor pan waits at an idle station while another is welded.



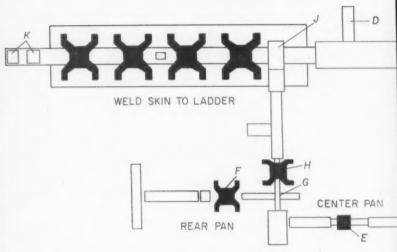


Fig. 9. (Left, center) At the end of the main line (K, Fig. 1) two tip-up units raise the floor-pan assemblies to a vertical position. Hangers on overhead conveyors then pluck them from the upturned arms.

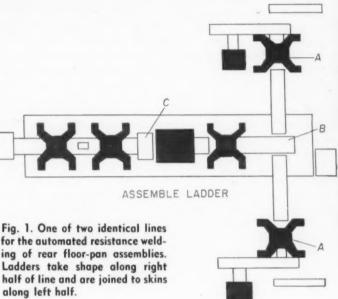
Fig. 10. (Left) Transferring of rear-pan skin from a side line onto shuttle-mounted welding fixture (G, Fig. 1), where it is aligned with center-pan skin. A press welder off to the right joins the two sections.



Fig. 6. Long conveyor carries ladder assemblies between the two main groups of press welders. A banking conveyor branching off from this line (right rear) is used for temporary storage.



Fig. 5. Floor-pan reinforcement is about to be added to the ladder assembly just after the indexing station. Part is manually placed on preloader, which then moves in to deposit it on the assembly.



ladder, approaching rear end first, is given one-quarter turn.

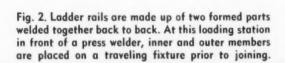




Fig. 3. Rails are placed on conveyorized fixture to build up ladder assembly. Left-hand rails are shown on this side of fixture; right-hand rails are stored on the opposite side.

Fig. 4. Indexing station (C, Fig. 1). The



spacers between them. The spacers and other small brackets are joined to the separate rail members on the individual spot-welding machines leading up to the main line. As has already been brought out, there are two groups of these smaller machines leading up to the same main line, one group fabricating left-hand rails, and one right-hand rails.

Flanking the head of the main line are two press welders (A, Fig. 1) on which the rail members are joined to form left- and right-hand outer rails. The loading station in front of the unit for left-hand outer rails can be seen in Fig. 2. Here, the man at the left is positioning an outer member on the conveyor fixture, after which the second man will place an inner member alongside it. The fixture position just in front of the welding area contains both members.

From the exit side of these presses the two assembled rails converge at a loading area (B, Fig. 1) ahead of the first machine in the main line. (This section of the line comprises four large press welders that work on the ladder assembly only.) Working from both sides toward the middle, the ladder is built up on a conveyorized fixture, Fig. 3. Added to the outer-rail assemblies are the shock absorber cross-member and the rear cross-member (which will support the rear

bumper). In the interest of safety, each of the four assemblers at this position must depress two palm buttons before the loaded fixture will advance toward the press welder. The ladder travels rear end first at this point.

In the first machine these pieces are united into one rigid part. Two side-sill inner reinforcements are added and welded in place at the second machine. The part is now advanced by a large shuttle.

Midway along the first section of this line (C, Fig. 1) is an indexing station. The ladder is lifted from the shuttle rails, Fig. 4, turned through an angle of 90 degrees, and redeposited. Now the right-hand side of the ladder faces the direction of travel, left to right in the illustration.

Other brackets are added to the ladder assembly as it continues through this first bank of four presses. It is done semiautomatically. For example, at the press welder immediately following the indexing station the center front floor-pan reinforcement is introduced, Fig. 5. An operator locates the reinforcing member on a preloader at the side of the machine which, at the proper moment, carries it into the work area and positions it on the ladder.

A long, double-track conveyor belt, Fig. 6, connects the two principal banks of press welders

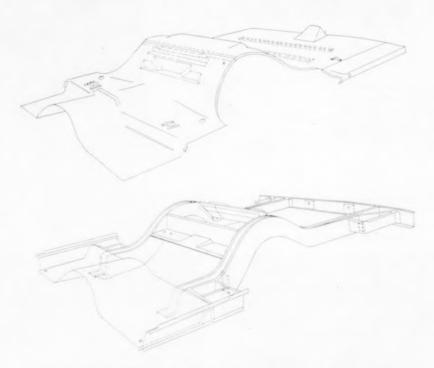


Fig. 11. Rear floor pan is built up from two major sections: skin subassembly, top; ladder subassembly, bottom. They meet at point (J) in the main welding line, Fig. 1.

in the main line. Facilities for hand spot welding are provided along the conveyor for use if required.

A banking conveyor (D, Fig. 1) tees off from this part of the line as can be seen at the right in Fig. 6. At certain intervals ladder assemblies are pulled from the main line onto the side conveyor for banking. The purpose of the banking area is to prevent a shutdown of the entire line if an interruption should occur in only one section. Should the final half of the line cease functioning, the first half can continue normal operation—the ladders being diverted onto the banking line until normal conditions are restored. On the other hand, if the first section of the line shuts down, the second section can continue while being fed from the ladder assemblies held in temporary storage.

Floor-Pan Skins Fabricated on Branch Line

Skin subassemblies for the floor pans are built up on a branch line located to one side of the main line. The branch line follows a crisscrossing pattern. Center-pan skin sections are built up on one side line $(E, \operatorname{Fig. 1})$, while rear-pan skin sections are built up on a second side line (F). Both lead into the branch line.

At the point where the shuttles carrying rearand center-pan skins cross each other (G) is an overhead transfer device. Using a group of six suction cups, the device lifts a rear-pan skin from its side line, carries it a short distance to the head of the branch line, and lowers it into position on a shuttle-mounted welding fixture, Fig. 10. The center-pan skin is already located on the fixture.

One more stop down the branch line brings the fixture to a press-welder (H, Fig. 1) where the

two skin sections are joined. Before this takes place, however, other small parts are added by hand. These include fuel-tank reinforcements and a pair of side extensions.

A conveyor transports the floor-pan skins from the welder to the main line, where they arrive at a marriage station (I). (There is another inspection and storage area leading off this conveyor.) Junction of the two lines is shown in Fig. 7.

The main line of ladder assemblies can be seen at the right, moving toward the left. The ladder assemblies are manually loaded into the marriage station. At the left in Fig. 7 is the branch line of floor-pan skins. A transfer unit at the end of this line picks up the skins, again by suction cups, and places them on the ladder assembly within the marriage station.

At the same time as this positioning is taking place in the marriage station, an operator loads a spare-tire bracket into a preloader associated with the first of the last four large press welders. Approximately 370 individual spot welds are made automatically in these four units. Fig. 8 shows one of the press welders in action on one floor pan while another awaits its turn.

When the pan assembly has passed through the last press welder it is then shuttled into one of two tip-up units (*K*, Fig. 1). At this point, two floor pans at a time are gripped by pneumatically operated fingers and swung to a vertical position, Fig. 9, forward end up.

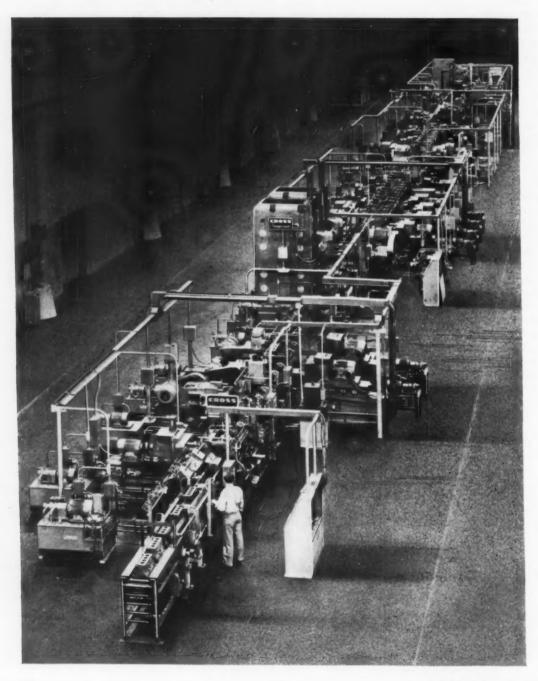
The floor pans are then engaged by individual carriers moving on a Link-Belt power-and-free conveyor and transported through a repair area. All assemblies traverse this portion of the system regardless of whether or not they require repair welds. Repairs are made by operators using handheld Airco CO₂, consumable-electrode, are spotwelding guns.

Brown & Sharpe Offers Plan for Modernizing Screw Machine Departments

Surveys have shown that almost 50 per cent of the single-spindle automatic screw machines now in use are from ten to twenty years old. Machines of that vintage are often operating at low efficiency. In some instances, automatic screw machines up to fifty years of age are still being used.

With a view to fostering the modernization of plants making screw machine products by replacing obsolete equipment, the Brown & Sharpe Mfg. Co., Providence, R. I., has originated a plan that offers a trade-in allowance of \$500 for each old Brown & Sharpe automatic screw machine, regardless of age or condition. This allowance will apply to the purchase of each new automatic screw machine. The offer applies only in the United States. It is the company's intention to send all old machines to a foundry cupola as scrap metal.

Increased Integration of Transfer Saves Floor Space



Modern transfer machines look larger. They are bigger. But because so much more processing can now be done in one line, the new transfers are actually spacesavers. Never before has so much continuous processing been possible in so little space. Here is how one high-processing-density transfer completes the machining of a whole engine block-with but two assembly operators

LAURENCE W. COLLINS, Jr., Associate Editor

TODAY'S TRANSFER MACHINES save more time, effort, expense, and space than did the machines of only a year or two ago. They save space without sacrificing accessibility for changing tools, and they automatically do more operations without any handling. A good example of the advances in transfer-machining setups is a new Transfer-matic machine (heading illustration) recently delivered by The Cross Company of Detroit, Mich., for processing four-cylinder blocks for a European car builder in three different horsepower ratings.

The biggest break with the past found in this machine is the integration of all milling and cylinder boring with all other operations required to prepare the block for assembly. With these operations consolidated in one straight line, large savings are realized in equipment engineering; materials handling; control circuitry; and, most of all, floor space. In addition, the standards of a single builder apply throughout the entire block-

production line.

Cast-iron blocks (192-241 Brinell), with their tops and bottoms broached, are loaded in the first station, Sections I and II, which comprise a total of fifty-one stations. The partially finished blocks are transferred out of Section II onto a banking conveyor that releases them to the load station of Sections III and IV, which comprise sixty-two more stations. When the blocks leave Section IV they go through a washer to Section V, where bearing caps are assembled on the block. In Section VI, camshaft bores are finished and crankshaft bores are semifinished, oil-slinger grooves are generated, and the crank thrust faces are finish-faced. The machines are designed according to industry standard building-block principles for straight-line transfers.

Block castings enter Section I pan face down and rear end leading. They are immediately rolled 270 degrees to remove broaching chips. Thus, the pan face is to the left side of the ma-

chine with the rear end still leading. First machining operations are drilling, spot-drilling, chamfering, and reaming the locating holes.

As soon as these holes are bored and the blocks can be accurately located, probes (Figs. 1 and 2) make sure there is room for tooling to enter in later operations. There is no point in doing any work on a casting if there is not stock enough for

the tools to "clean up" the surface.

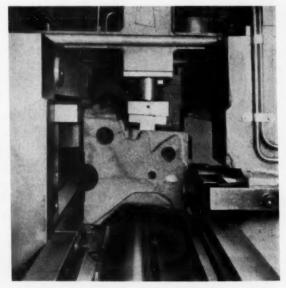
One probe is built to the dimensions of the camshaft boring-bar supports, and the other checks the block cavity for the tappet-hole bushing-plate clearance. Probes are positioned by gravity, and air circuits indicate interference. If there is interference, the block transfers to the next station and stops, where it is removed by the operator for manual inspection and rework.

Following an idle station, the crank bearings are straddle-milled. The heavy, ganged straddlemilling cutters are readily accessible for changing because in this section of the machine there are idle stations on either side of each working station. The milling-cutter feed unit withdraws the cutter from working position, Fig. 3, when cutters

are changed.

In the next two work stations, anchor-block notches and oil-slinger grooves are milled from the left side of the machine, and tappet holes are drilled from the right. Because of the attitude of the block in these stations, tappet holes are drilled upward at a 3-degree angle. Chips are dumped between these two stations by rocking the parts 180 degrees so that they will be clear to receive

Fig. 1. Probes are inserted in the block to make sure there is enough stock to clean up, as well as sufficient room for tooling in later operations.



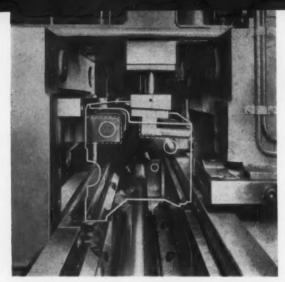


Fig. 2. Outline of the block superimposed on the probes shows how they fit into the casting to determine whether it can accept the actual tools.

The boring cartridges are housed in a watercooled compartment to maintain constant operating temperature. The saddle for the cylinder-boring spindles has an internal cast, center guide way for maintaining accurate alignment.

It is with these operations that some of the benefits of this transfer machine start. Because the whole line is conceived, designed, and built by The Cross Company, the engineering standards are uniform throughout, materials handling is common, fixture standardization is uniform, and electrical circuitry is the same. This all adds up to greater flexibility, less and faster maintenance, and a reduction in floor space.

For cylinder-boring stations, Fig. 4, the massive base units extend completely across the transfer line. The slide for each pair of spindles is mounted within a 7-ton cast column that is fastened on top of the base. These heavy units provide the foundation on which cylinder-boring accuracy is established. The columns, for example, were normalized for five days while still in their sand molds to assure stability. The greatest deterrent to accuracy in any boring operation is the distance between the ways and the center line of the spindle. The smaller this distance, the greater the accuracy. Through special design of these units, Fig. 5, the spindles and ways are on the same straight alignment to eliminate the forces that might divert the spindles from their true paths during the cutting cycle.

the bushing plate in the second station. The rocking unit is mounted in an otherwise idle station to reduce space and save the cost of an extra center base. Four alternate tappet holes are drilled in each station because adjacent holes are fairly close together.

Just prior to cylinder boring, the blocks are rolled over to the pan-face-down position. Again they are rolled 270 degrees to shift their attitude only 90 degrees, permitting chips from the last tappet-hole drilling operations to be dumped.

Alternate cylinders are bored in pairs in two stations. Individual boring spindles are mounted in cartridges designed so that they can be removed from the vertical slides simply. They have tapered roller bearings at each end of the spindle, and take-up adjustment can be accomplished through holes in the cartridges without removing the spindle or bearings.

Fig. 3. Straddle-milling cutter feed unit can be withdrawn so that the cutter can be removed easily with a hoist.



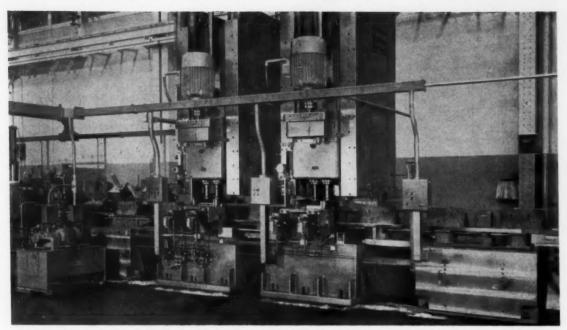


Fig. 4. Alternate cylinders are bored in twin stations. Bases extend clear under the line and support the columns, each of which weighs 7 tons. Note that ways and boring spindles are in the same plane.

Such special design is worthwhile. Without this construction, additional boring operations would be required to achieve the necessary accuracy. Therefore, costs are reduced.

For cylinder boring, cutters with ten inserted carbide blades are rotated at 175 rpm and fed at 18.3 ipm. Because there are three different blocks to be bored on this one machine and each has a different cylinder-bore diameter, cutting speeds vary from 150 to 126 sfm. The largest cylinder bore is 3.2638 inches.

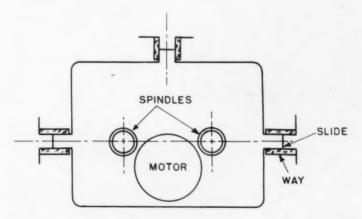
Transfer distance is 36 inches in Section I (through the cylinder-boring stations), with a simple rotary transfer bar sliding the blocks between stations. A neutral station between Sections I and II permits removing blocks to a bank

and replacing them in the line at this point, if necessary for scheduling purposes.

Section II has a lift-and-carry transfer mechanism, primarily because there is a fixed boring-bar support in this section of the line. The blocks have to be lifted and placed over this support in the camshaft line-boring station, Fig. 6. Transfer distance in Section II is only 24 inches because blocks are crosswise on the line, permitting operations from their ends.

"Free" motions are available in this section of the transfer because milling of the ends of the blocks is included in the line. The advance and return strokes of the transfer bars for Section II are powered by the same hydraulic cylinders that return and feed the milling cutters.

Fig. 5. Unusual design of the cylinder-boring slides shows how the slides and spindle center lines align to reduce side-play effects.



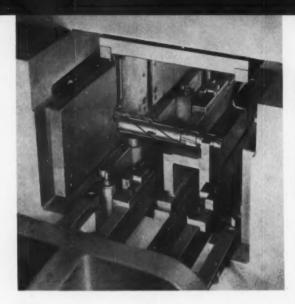


Fig. 6. The probes shown in Figs. 1 and 2 test space within the block for this camshaft boring-bar support. After the block is in position, the boring-bar feeds out and is supported on pillows.

Thus, a separate cylinder is not needed. At the end of the section the parts are automatically turned 90 degrees in the horizontal plane (so that the front end of the block is to the right) by motion of the transfer bars as shown in Fig. 7.

The four heads (two roughing and two finishing) for milling the ends of the blocks are identical inside and out, except that their directions of rotation are opposed, Fig. 8. The different roughing and finishing speeds are fixed by using different sizes of drive pulleys. Milling spindles are contained in quills that can be removed for service or adjusted for cutter location longitudinally.

The two saddles (each with a roughing and a finishing head for one end of the block) are driven by separate hydraulic cylinders piped from the same circuit. They are tied together with a large shaft through the center base of the machine. This connection shaft has a gear on each end that engages a rack mounted to the underside of the milling saddle. This assures that the heads move in unison on the return stroke.

At the end of a milling feed stroke, the ends of

one block have been rough-milled. In the meantime, two rough-milled blocks are in idle stations between the cutting stations, the next block has been finish-milled, and the transfer bars have been returned to the "forward-transfer" position (cutters feed in a direction opposite to that for block transfer, Fig. 9). The transfer bars then raise, and the saddle and bars move forward together, advancing all blocks one station and positioning the cutters for the next feed stroke.

This integrated motion serves two useful purposes. As previously stated, power for transferring the blocks is substantially "free." Thus, there is no relative motion between the cutters and the blocks. It follows that there are no problems of cutters returning over machined surfaces. If it had been necessary to introduce cutter movement to prevent scoring, another group of problems would have been added.

Rough-milling operations use 12-inch diameter cutters having fifty-four inserted carbide blades. They turn at 70 rpm to give a cutting speed of 220 sfm, and feed per blade is 0.0106 inch. Finish milling is done with 12-inch diameter cutters having fifty-two blades. They turn at 96 rpm to give a cutting speed of 300 sfm, and feed per blade is 0.008 inch.

Milling-spindle quills are mounted in split housings, Fig. 10, that permit easy removal and longitudinal adjustment. A fixed type gage-block is chained to the center base at each milling cutter so that tool location can be checked quickly. If adjustment is required, it is only necessary to loosen the locks and turn the quill wedge activator to correctly locate the cutter.

By the time the ends of the blocks have been

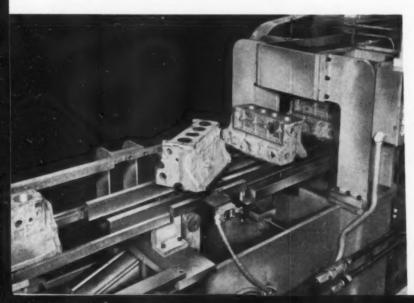


Fig. 7. Motion of the transfer bars automatically turns blocks 90 degrees in the horizontal plane before they enter the stations where the ends of the blocks are milled.

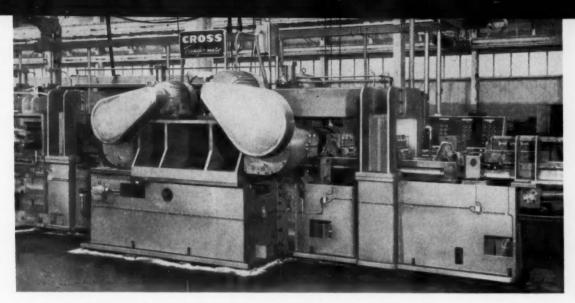


Fig. 8. Stations in which ends of blocks are milled have the part transfer from right to left, and cutter feed stroke from left to right. There is no relative movement between the cutters and the blocks while the blocks are being transferred.

milled, all of the heavy metal-removing operations have been completed. Because the remaining operations are comparatively light, generation of heat is minimized and internal stresses relax. The blocks have a chance to stabilize before the finishing operations are performed.

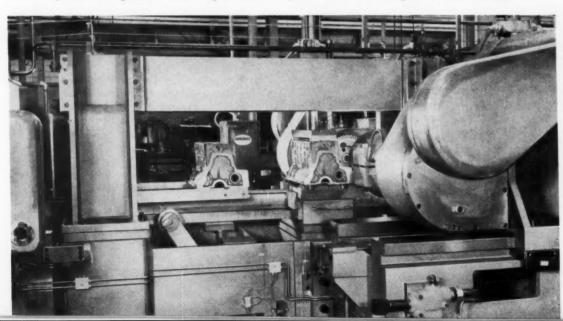
In general, the operations performed on Section II are conventional. One exception to this is the drilling of the oil-gallery hole, Fig. 11, in six different stations (along with other operations). Since these drills are long and slender, each is monitored by a Cross Protect-O-Tool unit. If any of these drills breaks, the machine shuts down. A blowout and probe unit checks holes at Station 47, and this is followed by an air-test unit to

check the block for porosity. The oil-gallery hole is plugged and air pressure is introduced. If leakage occurs during the test period, the porous casting is marked with a spray of yellow paint so that it will be removed from the line before further work is wasted on it.

In the final station of Section II, blocks are turned in the horizontal plane so that the front ends lead as they go to the banking conveyor leading to Section III.

Blocks are released from the banking conveyor by an escapement and shuttle into the first station of Section III. Rotary transfer bars of this section slide the block into the first machining station. Here, right- and left-side pads are milled.

Fig. 9. Viewed from opposite side of the line shown in Fig. 8, milling cutters have just completed cutting stroke to the right. Blocks in picture have been rough- and finish-milled.



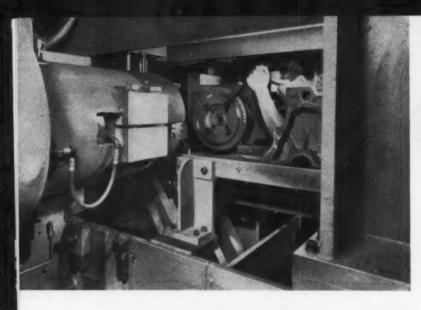


Fig. 10. Milling-spindle quills are mounted in split housings. Cutters can be replaced without moving quills, or quills can be adjusted without doing anything to cutters.

Since block transfer in this section is not tied to milling-cutter motions, the cutters have to be retracted while they are returned to their "startfeed" position, and the blocks are transferred forward to the next station.

Working from both sides of the Transfer-matic, many operations are accomplished in the next pair of working stations. In Station 6, five holes are drilled, four holes are core-drilled and chamfered, four holes are drilled, and four more holes are spot-drilled. In Station 7, the five holes are chamfered, the first group of four holes is reamed, three more holes are drilled, and another hole is core-drilled and chamfered. This illustrates the "processing density" that is possible with new designs in transfer machines.

Following blowout, probing, and tapping operations, the blocks are rolled over so that the pan face is at the right side. Then, the eight tappet holes are given a rough-ream in one station. In another station, both ends of the four cylinder

bores are chamfered from the right and left sides.

At Station 23, an angular milling head is used to rough-straddle-mill both ends of the distributor boss. A similar head is used to finish-mill these surfaces. These two pads (one for mounting the oil pump and the other for mounting the distributor) are straddle-milled because the surfaces must be parallel to prevent binding of the shaft when the parts are assembled in the holes.

Four 5/16-inch crank-bearing oil holes are drilled in two steps in two adjacent stations. In the machine special small wing bases are used in conjunction with special drilling heads. This bears out the fact that design freedom is not restricted in transfer machines, even though most of this Transfer-matic is designed with standard building-block units. Guide bars for these heads are permanently attached to the fixture and the wing base. The heads feed in and out on the guide bars. Cross engineers have found that deephole drilling can be successfully accomplished under most conditions on a transfer machine when hole depth is no more than eight or ten times the drill diameter. When slender drills are fed upward, as in the case of these oil holes, there is no need for a chip-clearing device because chips clear themselves. These holes are drilled to depth in two operations only to reduce cycle time.

Another neutral station joins Sections III and IV, permitting blocks to move directly between sections or to be removed for banking. In the meantime, the blocks have had sufficient time to stabilize since rough-reaming of the eight tappet holes in Section III. These holes are now chamfered in Station 49. In the next station, the tappet holes are semifinish-reamed. Eight stations later, they are finish-reamed in a station that is, in ef-

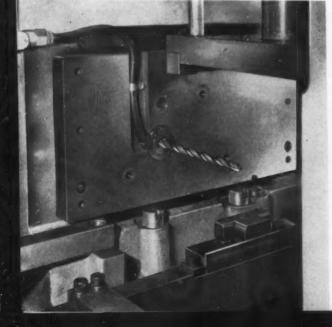
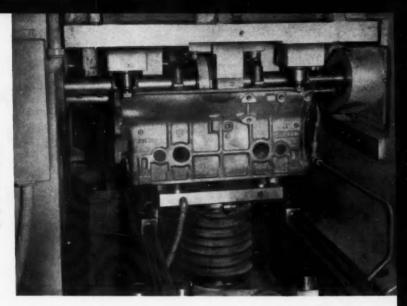


Fig. 11. Long, slender oil-gallery drills are monitored by Cross Protect-O-Tools. Should one of these drills break, the Transfer-matic automatically shuts down.

Fig. 12. In line-boring stations, blocks are elevated to working height. Here the crankshaft boring-bar can be seen in its cuts. Extra cutters on these bars will permit them to be used on six-cylinder engine blocks as well as four-cylinder models.



fect, isolated from the line. No other operations are performed in this station, and it has its own coolant system. Coolant is filtered before delivery at the reamers to assure the surface finish and accuracy required.

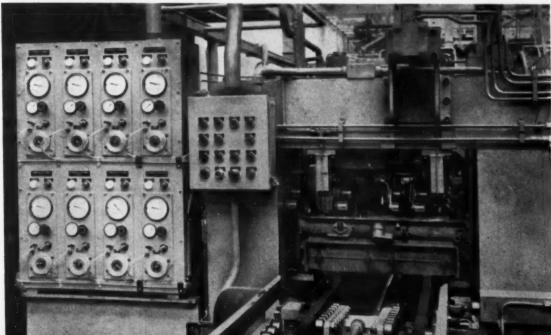
After leaving a chip washer, the blocks travel pan face up through a banking conveyor for delivery to Section V, the bearing-cap assembly machine. In the first station of this Cross machine, an operator manually places the four bearing caps. The bolts are manually inserted in Station 2 and are automatically torqued. These assemblers represent the only hand operations on the whole block line. The blocks are transferred through this machine on a simple roller conveyor. They are positioned by a side-acting rotary transfer bar of unusual design. The transfer bar operates inside

several split bushings. Dogs are attached to both the bar and the bushings. The transfer-bar dogs are rotated into the blocks and advance them one station. As the transfer bar is rotated in the opposite direction to free its dogs, the dogs on the bushings rotate into the blocks. This holds them in place while the transfer bar returns, and eliminates the need for shot pins or other expensive locating devices.

From Section V, the blocks move on an accumulating conveyor to a stop at the entrance of Section VI. An automatic loader here spaces the blocks and loads them two at a time into the first machining station.

In this first working station, the cam and crankshaft holes are semi-finish-bored. A pair of blocks (Continued on page 124)

Fig. 13. Air-gaging station checks each bore individually and simultaneously. One block is checked at a time, but two blocks are gaged during one cycle of certain other stations.



Velvet-Glove Fixturing Holds Fragile Part for Multiple-Form Cuts

LAURENCE W. COLLINS, Jr., Associate Editor

POLICE PROWL CARS sit with motors idling a great portion of the time. This—together with demands of the two-way radio, heater, and other accessories—causes a severe drain on the car's battery. Fugitives have gotten away because a dead battery would not start the prowl car when its engine stalled during a chase. Several years ago police began to substitute alternators for d-c generators because adequate current is generated by alternators regardless of engine speed. All Chrysler built cars for 1961 have an adaptation of the police alternator instead of a generator.

Built into the alternator are several rectifiers which convert the alternating current into direct current for charging the battery. On continuous duty, the success of the alternator lies in its efficiency. It is about 7 inches in diameter and pillow-shaped rather than cylindrical as is a conventional d-c automobile generator. The rotor shaft turns in antifriction bearings held in die-cast aluminum end bells called shields, Fig. 1, a ball bearing on the pulley end, and a needle bearing at the other. To dissipate heat efficiently, the end bells

have thin (0.120-inch) wall sections, large ventilating holes, and prominent rib fins.

When assembled to the alternator shell, the end-bell shield is adequately rigid. However, unsupported, the shield for the drive end is frail enough to be deflected easily with the hands. Thus, the part has proved a problem to chuck in a conventional manner and still maintain the specified tolerances on the small and large diameters and faces. Also—in true automotive production fashion—Chrysler's engineers wanted to bore, chamfer, under-cut, and face the bearing cavity in the center, and also bore, chamfer, under-cut, and face the outside diameter without a second chucking, at a rate of 320 pieces per hour at 80 per cent efficiency.

The problem, summarized, was as follows:

1. To hold the shield without distortion while

making eight cuts at once.

2. To make simultaneously, at approximately 2000 sfm (surface feet per minute), one group of four cuts 6.375 inches in diameter, and another four forming cuts 1.573 inches in diameter.



Fig. 1. Picture of a problem in chucking is the die-cast aluminum shield for the Chrysler Valiant electrical-system alternator. Close examination reveals the indentations left by the clamp studs just above each of the small holes in the right-hand view of the part.

3. To bore all diameters concentric to 0.0005-inch TIR (total indicator reading).

4. To hold all other specified tolerances.

5. To clear the chips generated in the small

Solving the problem of clamping the shield was the most difficult. All attempts to grasp it with wrap-around chucks failed because the dimensions of the fins varied. Sufficient pressure to securely chuck the parts for the cut was enough to spring them. When released from the chuck the shields would spring back to somewhere near their original shape. Thus the machined surfaces would frequently be out of round or lack concentricity. Wrap-around chucking at pressures so small as not to deflect the part were insufficient to prevent slipping of the work under cutting forces. Also, the machined surfaces were out of square with the bores.

Engineers of the Olofsson Corporation, Lansing, Mich., undertook the solution of the problem. They discarded the principle of holding the part around its periphery. Instead they designed and built a unique fixture embodying the "steel fingers in the velvet glove" approach. To achieve the necessary production rate, a Model 22 Olofsson precision boring machine was tooled for the job,

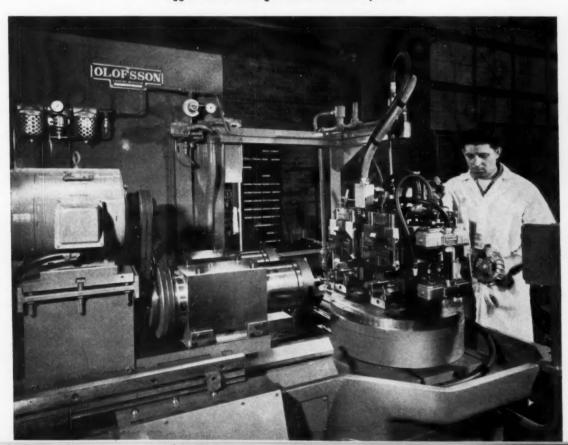
using a 180-degree indexing fixture with two of the velvet-glove fixtures on a side, and two special boring spindles, Figs. 2, 4, and 5.

Three reference points near the assembly bolthole bosses on the part were selected that would give accurate tripod support. Clamping force is exerted axially only, and in localized areas, where the casting gives a true bearing and is the most massive. The top work-piece reference point rests against a Braille stud in a raised pad on the clamp face. The lower reference surfaces of the work are clamped against two Braille rest studs, Fig. 3. When loading a fixture, the operator drops a casting over the tips of a pair of hold-back clamp fingers. Here it locates on its outside diameter, resting on vee type blocks.

In the top of the fixture is a toggle-operated slide that provides the velvet-glove damping action. When the operator pulls the toggle lever forward and down, the jacks on either side come down to rest lightly on the outside diameter of the shield casting. The coupling from the jacks to the plungers is a pin-and-slot design, arranged so that only the small weight of the jacks rests on the work-piece when the toggle lever is in fully lowered position.

The jack blocks float enough to allow both legs

Fig. 2. The operator loads parts on the indexing fixture of the Olofsson boring machine. Note the staggered drive arrangement of the dual spindles.



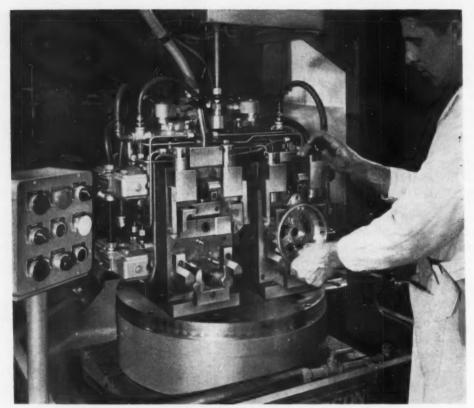


Fig. 3. When loading a part, the operator hooks the casting over the two lower clamp fingers and lowers the damping jacks with the black knobs. By pressing the cycle button on the control box to the left, he locks up the velvet-glove clamp and starts the machine sequence.



of each to contact the work equally. In the clamp base behind the jack guides is an air cylinder. Advance of its piston locks the jacks to prevent motion in any direction. However, all the operator does after he has placed a casting in each of the clamps on one side of the fixture is to pull down the toggle lever and press the machine's cyclestart button.

The automatic cycling sequence of the machine takes over. First, the top clamping finger swings down by air-piston action over the top of the casting. As the finger touches the casting and begins to pull back, air cylinders behind each of the two bottom clamping fingers simultaneously pull back. Pressure from all three fin-

Fig. 4. The dual Parker-Majestic spindles bore the castings at the optimum cutting rate of 2000 sfm. The four outside cutters turn at 1200 rpm, while the inside cutters turn at 5000 rpm. All bits are brazed carbide except the single Valenite throw-away tool cartridge clamped on the central boring-bars.

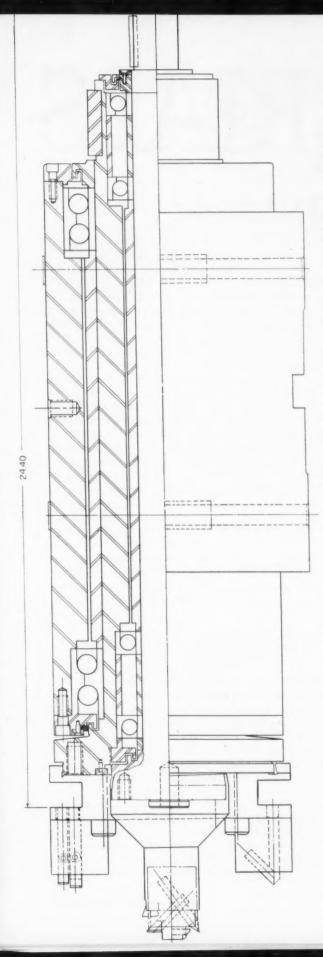


Fig. 5. A dual spindle for the end-bell operation requires unusual accuracy and rigidity to stand up to the combination of the radial and axial thrust loads imposed.

gers is powerful enough to indent the work firmly on the Braille studs. Finally, a piston advances to lock the damping jacks. The velvet glove is in place. There is no squeeze on the work.

Next in the machine sequence, the index-table turns 180 degrees. Rapid advance of the spindle slide follows, then shifts down into feed rate for machining. As soon as it reaches full depth of cut, the spindle slide reverses direction. Then, when it arrives at full-retract position, the cycle ends automatically. Machining time is ten seconds.

Excellent cutting-tool life is realized in these aluminum-alloy shields at about 2000 sfm. Consequently the tools making the four bearing-cavity cuts must turn at 5000 rpm, while the four outside cuts must be made at 1200 rpm. Therefore, outside the 5000-rpm inner spindle turns a second one at 1200 rpm, which carries the four boring, facing, chamfering, and under-cutting bits for the large-diameter cuts. Dual boring spindles for this Olofsson machine were made by Parker-Majestic, Inc., Detroit, Mich. The spindle drive motor for the outside cutting tool is mounted at the rear of the machine (Fig. 2), a few inches to the right, with its dual belts driving both outside spindles. The driven sheaves are large in diameter to reduce spindle speed. The front motor, staggered in similar fashion, drives both inside spindles.

Machine motions are hydraulic, electrically controlled, and powered by a variable-volume Racine hydraulic pump. All control elements in the system are standard JIC equipment; the panel is mounted for easy access. Rapid advance of the machine table is 5 3/8 inches at 3.45 ips (inches per second). First feed is 7/16 inch at 0.417 ips, and the second feed is 3/16 inch at 0.060 ips. The rapid return stroke is 6 inches at 2.72 ips.

Carbide cutters are used throughout. The outer spindle nose has four brazed, carbide-tipped tools as shown in Fig. 4. The smaller, inside spindle nose looks more like a conventional multiple-diameter boring-bar except that one of the four carbide cutters has a throw-away bit. A development of Valeron Corporation, Royal Oak, Mich., this Valenite boring tool-holder requires no adjustment, and thereby reduces tool-change time.

The operator loads the two parts on one face of the fixture in fifteen seconds. Machining cycle time is ten seconds. Therefore, loading time determines productivity.

MATERIALS

The properties and new applications of materials used in the mechanical industries

Wide-Range Temperature-Indicating Crayons and Paints

Easy-to-use devices that accurately indicate the temperature of any hot surface by distinct changes in color are now being marketed by Air Reduction Sales Co., a division of Air Reduction Co., Inc., 150 E. 42 St., New York 17, N. Y. The changes are not slight alterations in the shade of the original color, but an easily discernible change to a different color.

Called Thermocron crayons and DetectoTemp paints, the materials provide a means of measuring temperatures in a 104- to 2462-degree range; the crayons providing a range of 150 to 1240 degrees F. and the paints, the entire aforementioned range. Eighteen crayons and thirty-six paints are available from the producer.

These materials can be used on all hot sur-

There are approximately 12 square inches of 0.060-inch thick hard-faced surfaces on these two grinder centers. Life of this hard facing, known as Kenspray and developed by Kennametal Inc., Latrobe, Pa., is expected to be 100,000 or more pieces or operations, with ten regrinds.

Circle 620 on Readers' Service Card

faces, including those exposed to a reducing atmosphere, atmospheric moisture, traces of hydrogen sulphide, and carbon-dioxide concentrations of up to 50 per cent. Sulphur dioxide and ammonia affect only a few of the paints and have no effect on the crayons. The presence of high voltages, magnetic fields, ionized gases, and static electricity have no effect on the accuracy of the crayons or paints.

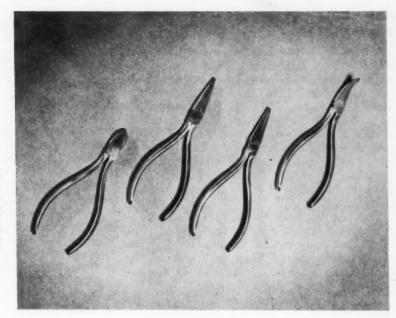
The Thermocron crayons are useful when rapid measurement of heated surfaces are required, such as leaky steam traps and welding, die, and bearing temperatures. They can be used during welding or extruding operations, heat-treating and annealing, and glass production. The DetectoTemp paints are most useful when large areas are to be monitored, when the temperature indicator must be applied before heating, and when the temperature range exceeds that of the crayons. They can be used for furnace walls, aircraft skins, jet engines, gas-turbine blades, air ducts, and exhaust lines. The paints can also be employed in unobservable areas such as power tubes in coaxial cables, brake drums, pistons, and other engine parts.

Circle 621 on Readers' Service Card

Hot-Work Tool Steel for Severe Applications

An air- or oil-hardening chromium-tungstencobalt steel especially recommended for hotpressing dies, mandrels, extrusion dies, and diecasting dies for copper, brass, and similar alloys with high melting temperatures is being marketed by the Uddeholm Co. of America, Inc., 155 E. 44 St., New York 17, N. Y. Called UHB Calmax, this steel has an extremely high hot hardness combined with a great toughness at high temperatures. Its resistance to heat checking caused by temperature changes is remarkably good. Distortion after hardening and tempering is insignificant, especially after air cooling. This steel is delivered in the fully annealed condition, allowing machining without difficulty.

Circle 622 on Readers' Service Card



This group of miniature safety pliers made of an alloy of beryllium and copper are nonmagnetic, noncorrosive, and do not spark under severe use. Produced and made available by the Beryllium Corporation, P.O. Box 1462, Reading, Pa., these tools were designed for use in volatile or explosive atmospheres to eliminate serious occupational hazards.

Circle 626 on Readers' Service Card

Adhesive Technique for "Welding" Nylon to Metal

A two-step process for chemically "welding" nylon to metal has been developed by Plastic Associates, 2900 S. Coast Blvd., Laguna Beach, Calif. The process makes use of an epoxy paste that chemically unites with the metal surface on which it is applied. A separate solvent solution applied to the nylon part softens the surface and allows the nylon molecules to blend with the epoxy bonding agent as the latter hardens. The entire operation is performed at room temperature and the result is a tough, shock-resistant union between the nylon and the metal within a few hours. The nylon treating agent is designated PA-749 and the other, PA-708.

The technique should find widespread use in such applications as the bonding of nylon gears to metal shafts or the securing of threaded screws or rods in nylon-and-metal assemblies.

Circle 627 on Readers' Service Card

Ceramic Powders for Shapes Used in Hot Tooling

Two ceramic powders that can be formed into shapes used in hot tooling have been announced by Corning Glass Works, Corning, N. Y. Known as Corcast and Cortamp, these powders can be used to make tools, jigs, and fixtures in the aircraft and missile industry, where shaping of exotic metals requires great heat and pressure. The powders are formed into shapes when and where desired. No separate firing is required, since bonding occurs in use.

Corcast has a service temperature of 2500 degrees F. and a compressive strength of from 2000 to 3000 psi. It has a thermal conductivity of approximately 0.723 Btu per foot per degree F. per hour and a density of 110 pounds per cubic foot. Shapes are formed by casting. Drying causes a negligible shrinkage, and no additional work is needed on a shape unless grinding is desired.

Shapes in Cortamp are formed by compaction. They are held together initially by organic bond, which shifts to a chemical bond at 1300 degrees F. and to a ceramic bond at 2700 degrees F. Its service temperature is above 4000 degrees F. Throughout the bonding stages its coefficient of expansion remains close to 3×10^{-6} per degree F. This material has negligible shrinkage—0.3 per cent—which occurs during the shifting from chemical to ceramic bonding. Its compressive strength ranges from 10,000 to 12,000 psi, and it has a thermal conductivity of approximately 1.08 Btu per foot per degree F. per hour and a density of 200 pounds per cubic foot. Pieces made of this powder can be ground and machined.

Circle 628 on Readers' Service Card

Screw-Machine Stock that Gives Consistency and Ease in Machining

An aluminum screw-machine stock which affords consistent and easy machining has been introduced by Kaiser Aluminum & Chemical Corporation, Kaiser Center, 300 Lakeside Drive, Oakland 12, Calif. A 2011-T3 alloy, called Micro-Chip, it comes color-coded and chamfered at both ends.

Circle 629 on Readers' Service Card

Cutting Fluids for Use with Multiple Metals

Cutting fluids with a wide service range, that maintain high machining efficiency across the board in different operations, are now being manufactured by Mobil Oil Co., a division of Socony Mobil Oil Co., Inc., 150 E. 42 St., New York 17, N. Y. Mobilmet Cutting Fluids, as they are called, contain a phospho-sulphurized additive which controls the built-up edge on the cutting tool as pressure-temperature conditions change due to operations or metals. This makes possible optimum machinability of different metals without changing oil.

These cutting fluids can be used to advantage in numerical-control machine tools and in automatics that are required to handle many different jobs in rapid sequence. Their use can drastically reduce the number of cutting fluids kept in inventory in large production plants.

Circle 630 on Readers' Service Card

Conductive Sealing Gasket Material for Wide Temperature-Range Use

A silicone-rubber and metal material that can be used for conductive gasketing purposes has been developed by the Connecticut Hard Rubber Co., 407 East St., New Haven 9, Conn. This conductive gasketing conforms easily to irregular surfaces and is impervious to fluids.

Called Cohrlastic silicone-rubber conductive gasketing, it is available in a 30- or 24-mesh aluminum-alloy wire cloth impregnated with a 50-durometer silicone rubber to a thickness of 0.016 or 0.020 inch. The material is recommended for use where a necessary conductive material is needed between two metal surfaces to allow the flow of electrical current while restricting or filtering any induced radio frequency. It is suited for wave-guide gasketing, shielding between magnetos and their bases, in ignition harnesses, and in quick disconnect plugs.

Circle 631 on Readers' Service Card

Tool Steel that Combines Wear Resistance with Machinabilty

An oil-hardening graphitic tool steel with outstanding resistance to abrasive wear, galling, scuffing, and scoring has been made available by Darwin & Milner, Inc., 2222 Lakeside Ave., Cleveland 14, Ohio. Called Dargraph, it is an AISI-SAE Type O6 steel and has a percentage composition of: carbon, 1.45; manganese, 0.80; silicon, 1.15; chromium, 0.20; molybdenum, 0.25; phosphorus, 0.03 max.; and sulphur, 0.03 max. The carbon content is uniformly distributed as free graphite to increase its antifriction proper-

ties. The material is used for the making of wear plates; gages; and blanking, piercing, and cutting dies.

Circle 632 on Readers' Service Card

Spray-on Damping Compound Stops Vibration and Noise in Metal Structures

A viscoelastic material which, when sprayed or troweled onto a metal plate, greatly reduces structurally borne noise and vibration has been announced by the Korfund Co., Inc., 48-39M 32 Place, Long Island City 1, N. Y. This compound, called Korfund Vibrodamper, renders metal plate acoustically equivalent to a sheet of cork.

The compound is handled like a coat of paint, dries to a smooth attractive finish, and is non-toxic and nonflammable. It is resistant to the effects of alkali, grease, gasoline, and aliphatic oils, and is unaffected by ozone or sunlight. It does not become brittle or change in any way with age. Uses include sheet-metal applications such as air ducts, plenums, and metal doors.

Circle 633 on Readers' Service Card

Zinc-Base Sheet Metal that Does Not Creep or Sag

An alloy of zinc, copper, and titanium which retains all the basic advantages of zinc and also provides the structural strength, stability, and scope of other nonferrous metals is being marketed by Whitehead Metals, Inc., 303 W. 10 St., New York 14, N. Y. Hydro-T-Metal, as it is called, solders easily, can be fusion-welded, can be deepdrawn without work hardening or annealing, and can be spun, extruded, stamped, coined, embossed, and perforated. It is nonmagnetic, nonsparking, lightweight, self-lubricating, and machines well.

Circle 634 on Readers' Service Card

Austenitic Iron-Base Alloy for Elevated-Temperature Use

An austenitic iron-base alloy containing nickel, chromium, and relatively small proportions of molybdenum, titanium, boron, silicon, and manganese has been made available by Westinghouse Electric Corporation, Materials Manufacturing Department, Blairsville, Pa. This alloy, called W-545, is precipitation hardening and was developed primarily to meet the need for improved gas-turbine discs, one of the most critical components of jet engines. It has high creep strength combined with good ductility, resistance to notch sensitivity, and good oxidation resistance in the temperature range of from 1000 to 1350 degrees F.—the range in which gas-turbine discs operate.

Circle 635 on Readers' Service Card

The Quality Control Program Behind Ford's Extended Warranties

(Continued from page 95)

Keeping management constantly and promptly informed is an important task of the total Ford quality-control activity. Information from plant and division quality-control departments consists of various types of analysis reports, such as: the effect of engineering changes on gaging and initial sample programs; process and machine capability studies; quality performance of suppliers and production operations; quality problems that are the joint responsibility of supplier and consumer, and their solution; field performance of the product; and similar analyses. Promptness, accuracy, and freedom from omission are prime requisites of quality analysis and reporting. They are vital tools of managed quality control.

In addition, Ford's vehicle divisions analyze dealer repair orders processed under warranty and policy, and publish confidential reports on field experience showing the quality of Ford products. The purpose of these reports is to keep a rapid, pinpointed, running record of quality after the sale. To get the desired data, it is necessary to: accurately identify modes of failure in sufficient detail to permit rapid analyses and the development of corrective action; and measure the cost of correcting quality problems in the field by determining and apportioning the cost of repairs absorbed by the customer, by the dealer, and by the company.

The reports come in from a network of volunteer dealers of all sizes, scattered all over the country, selected as a representative sample, for which company representatives make repair order analyses. Each month certain cars sold by these dealers are designated for follow-up survey in the program. A special repair record of these selected cars is kept for twelve months. Data in the records include such vital information as the details of the customer's complaint, the parts at fault, the repairs made, and the mileage and age of the car.

These company representatives analyze the accumulated repair reports and submit their findings to the divisional staff for summarization and publication. Headquarters and division managements thus have a unique tool for quality management that is a current, nationwide report listing the specific problems experienced by new-car buyers. Corrective action can thus be fast and effective. From such information production supervisors carry out corrective measures in cooperation with product engineering, manufacturing

engineering, and quality control. Good communications expedite needed changes.

Warranty and policy reports fix the causes of failure, as well as chart the frequency of occurrence and average cost of repairs per unit sold. The quality-control department can also arrange with the service department for the recall of defective parts from dealers based on its judgment of the need for exhaustive study of recurring problems.

Since it first started, the results of the organized effort toward improving quality were immediately noticeable and evident. A plateau was reached in the approval of the company's products for 1960, shown by the unusually spectacular success of the Falcon.

The outstanding and fast acceptance of Ford's Falcon model may be traced in part to the fact that it was the first product produced entirely under the program. The design must have been good and the car must have been well made from parts that could be assembled to specifications. No engineering changes had to be made after delivery of the cars.

The success of this new quality-management tool has given the system stature which will stimulate further growth, and will influence other adaptations of reliability engineering and quality production. Vendors of machines, components, raw materials, gages, and many services to Ford, and other companies, using versions of managed manufacturing and assembly will note many significant changes in requirements, specifications, and standards.

Idealists in manufacturing will be inclined to do some Monday-morning quarterbacking as the result of this new manufacturing concept. It is they who over the years have said that with modern tools, reasonable care, and good design it is just as easy and economical to make a good product as to knock out a sloppy one. The customer is the direct beneficiary. Indirectly the company should benefit in repeat sales. Sales of Ford products should improve because "there is no salesman like a satisfied customer."

In addition, for the 1961 models, announcements by Ford Motor Co. of the warranties being extended from three months or 4000 miles to twelve months or 12,000 miles is positive proof to the buying public that the company stands back of its new concept in managed quality.

Increased Integration of Transfer Saves Floor Space

(Continued from Page 115)

is elevated to a position 0.080 inch below final position so that as the boring-bars are inserted, the cutter bits will clear the holes. The blocks are raised to working height and the boring-bars are fed through the holes, Fig. 12. Retraction of the boring-bars is done with a two-step lowering of the blocks, and after positive stopping of the bars so that the cutter bits point down. These long boring-bars are supported by live bushings on the outsides of the blocks and by fixed supports within the blocks.

After finish boring, blocks move to the next station, where chips are removed by automatic brushes and an air blast. Following cleaning, the blocks go to the air-gaging station, where all bores are checked (Fig. 13). If a fault appears, an indicator light identifies the incorrect hole.

Because only one block is gaged at a time, the lift-and-carry transfer bars have an unusual cycle. After the first block has been gaged, this block and the next are both lowered onto the transfer bars, which have been retracted 20 inches. The bars are then brought forward 20 inches, which places the second block in gaging position. After the second block is gaged, the transfer bars put the blocks back in correct relation to other blocks in the machine. Thus, on the next transfer (60 inches forward) they are deposited in the unload station.

All of the tooling on this machine has been designed so that either four-cylinder blocks, as at present, or even six-cylinder blocks can be machined and checked without changing tools. Later, when and if six-cylinder blocks are used, the only major change that will be required is the moving of the side guides at the load and unload stations to accommodate the different lengths of blocks that will be processed.

Processing these blocks requires complete finishing of 123 different holes—many of which require several types of operations—and the milling of a large number of surfaces. If this machine were to operate at 100 per cent efficiency, it would turn out 109 blocks per hour.

Actually, since so many drilling operations are accomplished in Section IV, the cycle time for Sections III and IV has been made shorter (thirty-three seconds, as compared to thirty-six sec-

onds for Sections I and II) in anticipation of

greater down time for changing drills.

Section V has a short cycle time and easily meets the line production rate. Section VI has a cycle time of fifty-four seconds; but since it processes parts two at a time, it too has extra capacity.

In production the sections of this Transfermatic balance out at between eighty and ninety blocks per hour.

Abrasion Resistance of Tool Materials

Abrasion resistance is the property which permits a tool material to resist wear due to rubbing. This property is related to hardness in that abrasion resistance increases with increased hardness. However, it is often found that there are considerable differences in the abrasion resistance of various tool materials which have the same hardness. The high-vanadium high-speed steels are notable for their properties of abrasion resistance. These characteristics are pointed out in an article in "Metal Cuttings," a publication of National Twist Drill & Tool Co., and Winter Brothers Co.

In some cases the best combination of abrasion resistance and toughness is obtained through the use of a standard high-speed steel to which a hard-case surface treatment is applied. Such treatments are particularly advantageous in reducing margin wear on drills.

Hard-case treatments are brittle; therefore they

should not be applied to small tools except on a cautious experimental basis. These treatments are usually not applicable to the highly alloyed superhigh-speed steels which inherently develop high hardness. When so treated, these steels become so brittle that they usually suffer early failure due to chipping.

Resistance to galling is often confused with abrasion resistance. This is because particles of work material which weld to tool surfaces often break off, carrying small particles of tool material with them. The result may look like extreme abrasive wear. With high-speed steel, galling can often be reduced through the application of a black-oxide surface treatment to the finished tool. This does not increase surface hardness, but the oxide film acts as a powerful antiseize agent. This treatment is particularly effective on drills, but its effectiveness varies with the type of material cut.

MACHINERY'S

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DESIGNING FERROUS PARTS FOR FURNACE BRAZING WITH COPPER

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JANUARY 1961

Designing Ferrous Parts for Furnace Brazing with Copper

The copper bonding of ferrous parts by furnace brazing has advantages for many types of work. This article contains a basic review of the know-how of the process for product designers. The various practical applications discussed here are from case histories supplied by the Superweld Corporation

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PERMANENT JOINING of two or more ferrous parts under high temperature can be accomplished by an atomic bonding through the intermediation of a fused nonferrous filler metal whose melting point is lower than the base metal. The process is called brazing when it is carried out at a temperature above 800 degrees F., without the actual melting and deformation of the parent parts (which occurs in fusion welding), and the filler metal is distributed between closely fitted surfaces of the joint by capillary attraction. This article primarily deals with the design of ferrous parts for furnace brazing using copper as the filler metal. Since, basically, the same considerations apply, the brazing of high-alloy steels with special alloy fillers for high-temperature applications will also be discussed.

A typical facility for copper brazing is an automatic-charging roller-hearth conveyor type electric furnace which employs a controlled slightly reducing atmosphere to promote the flow of the filler metal and prevent oxidation of the parts being processed. The parts are slowly heated, bonded, and then cooled, all within the protective gas envelope to prevent discoloration and to minimize distortion due to thermal stress. Assemblies brazed in this manner remain clean and bright, without the necessity for pickling or other cleaning.

A furnace atmosphere commonly employed is made by the exothermic burning of natural gas and compressed air over a nickel-impregnated catalyst brick. The products of combustion are

thoroughly dried before being introduced in the furnace.

A designer must have a clear understanding of a process in order to gain any advantages it offers. In the case of copper brazing these are: high-strength joints, pressure-tight joints, economy through the use of low-cost steels, the elimination or reduction of machining operations, and good appearance of the finished parts.

The cost of even the most intricate assemblies can be greatly decreased by arranging them into simpler components. Machining operations can be reduced by using stock parts such as standard gears, bolts, washers, and tubing. Stampings will often take the place of castings or forged parts, and screw machine parts substitute for more expensive components. Theoretically, there is no limit to the number of joints in an assembly which may be brazed in one trip through a furnace. Practically speaking, the greater the number of bonded joints in an assembly, the lower the cost per joint.

Copper-brazed parts may be heat-treated, annealed, carburized, or nitrided after bonding. The temperatures involved in these processes are all below the melting point of a copper-bonded joint. Finish machining before bonding is practical in most cases, since parts do not require pickling or cleaning after brazing. But machining to very close tolerances should be avoided, as decarburization, distortion, or misalignment can occur and cause complications.

While it would be very handy for the design

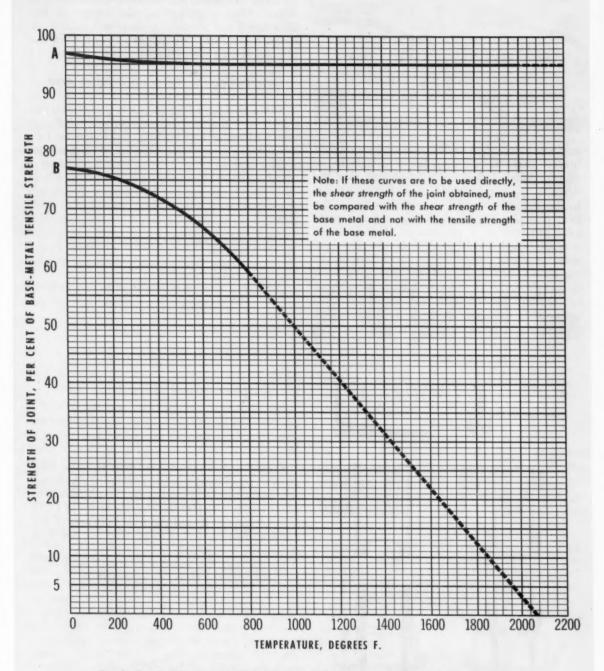


Fig. 1. Graph showing relation between brazed-joint strength (expressed as percentage of base-metal tensile strength) versus temperature for nickel-silicon-boron alloy (curve A) and copper (curve B) brazing fillers. The dotted portions of the curves are for the purpose of representing the temperatures at which degradation of the brazed joint can occur through progressive oxidation.

MACHINERY'S REFERENCE SECTION

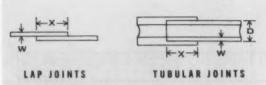


Fig. 2. Diagrams showing how the symbols in the formulas are applied to lap and tubular joints.

engineer to have a fixed design value for a copperbrazed joint, the strength factor cannot be so simply stated. It has been established that the strength of a brazed joint is directly proportional to the strength of the base metal in which the joint is made. The chart shown in Fig. 1 plots joint strength as a percentage of the tensile strength which would exist if the bonded area were not a joint but solid base metal. Two curves are shown, representing joints that have been furnace-brazed with different filler metals. These curves were plotted from tests made on many units from different sources, and have been proved in practice.

When using the chart in Fig. 1 to determine

the strength of a joint, the shear strength may be taken as one-half the ultimate tensile strength shown. Thus, a joint employing copper as the filler metal and stressed in shear will exhibit, at room temperature, one-half of 77 per cent of the ultimate tensile strength of the parent metal.

Determining the Necessary Bonding Area

Although a lap whose length is three times the thickness of the thinnest member will hardly, if ever, fail under any loading, the following formulas may be used for accurate determination of joint overlap (Fig. 2):

$$X = \frac{\Upsilon T W}{L}$$

where

X =depth of shear area required, inches

 Υ = numerical safety factor

T = ultimate tensile strength of thinnest or weakest member, psi

W = wall thickness of thinnest or weakest number, inches

L =shear strength of joint, psi

but since

$$L = \frac{TQ}{2}$$

where

Q = percentage factor from Fig. 1

$$X = \frac{\Upsilon T W}{\frac{T Q}{2}} = \frac{2\Upsilon W}{Q} \tag{1}$$

Example: A copper-brazed part is to be used at room temperature in the as-bonded condition. It is made of C 1015 steel having an ultimate tensile strength of 60,000 psi. A safety factor of 1 1/2 is to be employed, and the wall thickness of the thinnest member is 1/8 inch. Find the depth of shear area X required.

In this case, the value of Q from Fig. 1 is 77 per cent, and therefore, using Equation (1)

$$X = \frac{2 \ Y \ W}{Q}$$
$$= \frac{2 \ (1 \ 1/2) \ 1/8}{0.77}$$
$$= 0.487 \text{ inches}$$

Fig. 3. Wherever possible, brazed joints should be stressed in either shear or compression. Here are a number of acceptable designs.

For tubular joints (Fig. 2) the following equation will give the necessary bonding area:

$$X = \frac{Y T W (D - W)}{L D}$$

$$= \frac{Y T W (D - W)}{\frac{T Q}{2} D}$$

$$= \frac{2 Y W (D - W)}{Q D}$$
(2)

where

D = diameter of shear area. inches

Example: A part which is to be heat-treated to Rockwell C 28 to 30 after copper brazing is to be stressed at a maximum temperature of 300 degrees F. in service. The weakest member has an ultimate tensile strength of 134,000 psi and a wall thickness of 0.062 inch. The diameter of the shear area is 1 inch, and a safety factor of 2 is necessary. Find the depth of shear area required.

At 300 degrees F., Q for copper from the chart (Fig. 1) is read as 74 per cent. Then by substituting the required values in Equation (2):

$$X = \frac{2 \Upsilon W (D - W)}{Q D}$$
$$= \frac{2 (2) (0.062) (1 - 0.062)}{0.74 (1)}$$
$$= 0.31 \text{ inch}$$

The maximum safe service temperature for continuous operation of parts brazed with copper is considered to be 800 degrees F. Above that point, oxidation may act to decrease the effective area. Copper-brazed parts evidence no adverse effects from operating temperatures as low as minus 100 degrees F. or, for short periods, from temperatures of 1800 degrees F. (as during heat-treatment). Any ferrous metal may be copper-brazed. However, a good designer will always first consider using plain, low-carbon steels whenever possible. Carburizing or work hardening after bonding is possible when annealed SAE 1010 does not have sufficient stiffness or surface hardness.

For economic reasons, it is best to avoid the following elements in material selection: chromium, manganese, silicon, vanadium, aluminum, zinc, sulphur, and titanium. At high temperatures these elements may form selective

Fig. 7. Holes should be provided to vent closed assemblies and dead-end holes, which may act as pressure vessels during the brazing process.

THICK AND THIN SECTIONS



TORQUE REVERSAL



Fig. 4. Tearing of a thin member due to flexure at the edge of a joint (upper left) can be avoided by the design seen at the upper right. Where torque reversals are involved, the design at the lower right will better distribute the stress.

EQUAL-UNEQUAL MASS



GOOD

Fig. 5. Approximately equal mass on each side of a joint is desirable. Unequal expansion may cause voids in joint (A) and stop filler flow in design (B).

LARGE MATING RADII

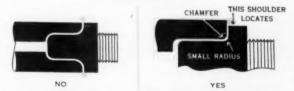
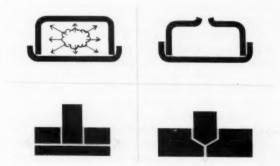


Fig. 6. Parts to be joined should not have large mating radii or be positioned by double shoulders. Locate with a single shoulder and employ a small radius matched with a chamfer.



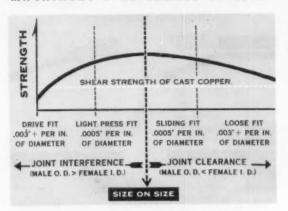


Fig. 8. Graph showing how the strength of a copper-brazed joint is affected by the type of fit.

oxides which inhibit good bonding. If parent metals contain more than 1 per cent of any of these elements, special care must be taken in joint design and surface preparation. Caution must also be observed in designing joints involving metals with different coefficients of thermal expansion, since different rates of expansion may affect clearance and, hence, the strength of the completed joint.

Design of Joints

If possible, joints should be designed to be stressed in shear or compression (Fig. 3); lap joints are recommended wherever practical. As previously mentioned, a lap whose length is three times the thickness of the thinnest member will practically never fail. Butt joints should be used only if metal-to-metal contact can be maintained throughout the bonding cycle. T-joints and corner joints are butt joints.

When a joint involves a thick and a thin member, flexing of the thin member may set up a tearing action at the edge of the joint. This may be avoided by slight changes in the design, as shown in Fig. 4. Joints having approximately equal mass on each side prevent possible difficulties caused by unequal expansion of light and heavy members during the brazing cycle, Fig. 5.

Large mating radii should be avoided, as visual inspection cannot detect possible voids in such joints. Positioning of the parts by double shoulders should also not be attempted; use one positive shoulder for location and match the radius with a chamfer as shown in Fig. 6.

Closed assemblies such as tanks or pressure vessels should be provided with vent holes. Unless this is done, expansion of gases in the interior may force the components apart during heating.

Dead-end holes may act as small pressure vessels. These may be vented as shown in Fig. 7. Clearance, where parts fit into one another, is very important to the ultimate joint strength (Fig. 8). When a heavy drive fit occurs, due to normal variation in mass-produced parts, there are almost always surface prominences which will cause high local pressures during the bonding and produce actual grain growth across the boundary. This can act as an effective barrier to the flow of filler metal, and may result in a partially filled joint of reduced strength values.

What About Fillets?

Inspectors like to see fillets, and, in general, the presence of a neat, concave fillet is a good thing. A brazed joint is actually a small casting, and therefore can sometimes benefit by being able to draw upon the reservoir of metal in the fillet to feed itself, to compensate for shrinkage during solidification.

In certain types of joints, a fillet can provide



Fig. 9. A fillet will assist in distributing the bending stress in this case.

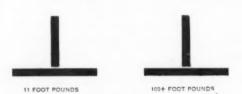


Fig. 10. Izod impact tests caused part (left) without fillet to fail at 11 foot-pounds; part with generous fillet (right) failed at over 100 foot-pounds.

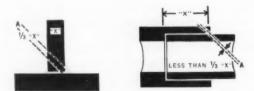


Fig. 11. A fillet will add strength to a joint only when dimension (A) approaches 30 per cent of dimension (X). T-joint (left) will benefit from a fillet, while tubular joint (right) will not.

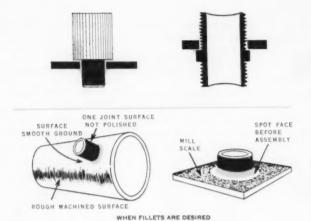


Fig. 12. (Left) Rough-machined surfaces, rust, and mill scale will prevent formation of fillets. Provide smooth surfaces or a blocking lay of tool marks to prevent capillary flow away from joint where fillets are desired. Fig. 13. (Below) Blasting of parts with steel grit before assembly will prevent fillets from forming.



additional joint strength against certain stresses, as indicated in Fig. 9. Izod impact tests were made, in one instance, on a T-joint of the type shown in Fig. 10. Without a fillet, failure occurred at about 11 foot-pounds; with a fillet purposely made larger than normal, this figure was raised to more than 100 foot-pounds.

A good working rule for deciding on the inclusion of fillets in the joint design is illustrated in Fig. 11. Whenever dimension A approaches 30 per cent of dimension X, a fillet can be included to advantage. Thus, the fillet can add strength to the T-joint, but on the tubular joint it will be so relatively small as to provide no value. However, due to the limitation of practical fillet size, fillets are of importance only when dimension X is less than 1/8 inch.

Knurling, surface roughness, rust, mill scale, or threads which interrupt or touch joint surfaces provide capillary passages for the flow of the filler metal and prevent the formation of fillets. Hence: when fillets are required, polish, machine, or grind the surface, or provide lay of tool marks, so that capillary flow away from the joint area will not occur (Fig. 12). When fillets are not desired, blast parts before assembly with 80-mesh steel grit. The copper will spread, leaving practically no fillet (Fig. 13).

A joint with 0.0005-inch clearance, having a normal ultimate shear strength of 23,000 psi (77 per cent of the shear strength of the base metal at room temperature—Fig. 1), remained unbroken after 10,000,000 reversals of a torque supplying an alternating load of 10,600 psi. On another sample, an increase in torque loading to 11,000 psi brought about metal failure after 10,000,000 reversals. Whenever samples with light interference fits have been tested, the mild-steel base metal—not the joint—has failed if load-

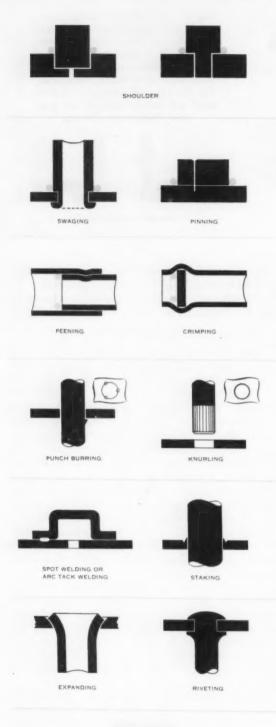
ing passed this point. Also, in practice, fillets would remain to reduce maximum stress in the joint, whereas they were removed by machining for the test above.

Locating Parts for Bonding

Metal-to-metal contact throughout the joint area must be maintained so that sufficient alloying can occur. Alloying takes place when (1) either the parent metal or any of its constituents dissolves in the molten filler material, or when (2) some of the molten filler material diffuses into the solid surfaces of the parent metal. This can occur when the equilibrium systems of the paired solid and liquid metals show definite evidence of intersolubility, either as solid-solution phases or as intermetallic compounds. This intersolubility can cause rapid increases in the viscosity of the filler metal during its flow. Hence, although a light press fit is usually recommended, it may sometimes be necessary to provide appreciable joint clearance when certain alloy combinations are present.

To prevent movement and slippage of parts during the bonding cycle, self-locating features should be provided. They allow rapid and inexpensive assembly and hold the work to the required tolerance. A shoulder is one of the best and simplest methods, but there are a number of others which are frequently used, as shown in Fig. 14.

A light press fit is most often used in order to gain maximum joint strength where the joint area is restricted because of weight considerations. Since manufacturing tolerances should provide from 0.00025- to 0.001-inch interference per inch of joint diameter in order to gain this joint-strength advantage, the cost of close tolerances versus that of providing greater joint area with



TEMPORARY SCREW

wider tolerances should be calculated. Whenever joint length exceeds joint diameter, the additional cost involved in providing a light press fit is considered unnecessary. Sufficient surface roughness or a knurl on the male member will prevent parts from slipping.

When press fits are used, the outer component should not be heated, as the resulting scale may cause unsound joints. A light press fit is all that is required. In cases involving long tubular sections where alignment is essential, refrigerating the inner member in dry ice before assembly may aid in location.

Flow of Filler Material Is Important

The following suggestions should help the designer plan joints to take advantage of both gravity and capillary flow of the filler metal: If possible, arrange the assembly so that the filler material will be above the joint during the bonding cycle. Provide a locating surface for the filler metal—an external or internal shoulder, groove, chamfer, or similar feature, Fig. 15. For lap joints, design the part so that the maximum length of flow of the filler metal is less than 1 1/2 inch from the point of entry. If longer flow is necessary, provide wells inside the joint to hold rings of filler metal.

Provide, whenever possible, for inspection at both ends of a joint. If this is impracticable, try to provide for inspection at the end opposite entry of the filler metal. Parts should not be too smooth. For best results, the surface roughness of joint areas should be between 100 and 250 micro-inches on the inner member, and not smoother than 40 micro-inches on the outer member. If centerless grinding is used on the male member to obtain close tolerances, the male bonding surface should be blasted with steel grit or liquid-honed for assembly. Any hydrocarbons left on the joint surfaces of an assembly-either through handling, improper degreasing, or carelessness-may prevent proper bonding and result in markedly lowered joint strength.

Visual inspection seems to be the best, despite the increasing use of newer methods. A good inspector, familiar with copper brazing and the functional requirements of the part, will usually detect any questionable unit. However, if visual

Fig. 14. Various methods of preventing movement and slippage of parts during furnace brazing. A shoulder is one of the best and simplest means.

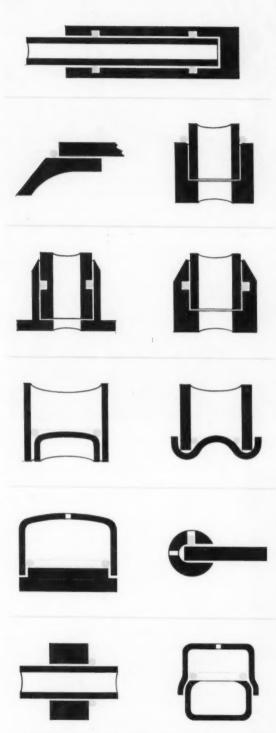


Fig. 15. Here are a number of ways to locate the filler metal for brazing. It is best to place the filler above the joint, if possible.

inspection cannot meet a particular set of special requirements, and if the additional expense is warranted, inspection can be made by X-ray, proof testing, chemical corrosion testing, metallographic examination, or ultrasonic testing, depending on the nature of the work.

Applications of Furnace Brazing Using Copper and High-Temperature Filler Alloys

The brazing of close-tolerance components has long been a problem. Many parts having tolerances of plus or minus 0.010 inch have been manufactured in experimental brazing programs. The part shown in Fig. 16 is a hydraulic manifold manufactured by the Nortronics Division of Northrup Aircraft Co. for the Hawk missile. It is a good example of a close-tolerance component required in high-production quantities. The tubes, which are made of AISI type 321 stainless steel, have thin walls and are copper-brazed to machined connectors of much larger mass. This differential in masses makes close tolerances extremely difficult to maintain.

To produce the parts, fixtures were employed to insure that tolerances were maintained throughout brazing. The brazing alloy is applied after the manifold is assembled in the fixture, and all forty-four brazed joints and thirteen connections are checked for proper location prior to

placing the part in the furnace.

If the completed assembly is within tolerance, the fixture is enclosed in a retort, which is then sealed and purged with nitrogen. After purging, a traveling furnace is positioned over the parts, and dry hydrogen gas having a dew point of minus 100 degrees F. is admitted to the retort. The temperature is raised to 2050 degrees F., held a few minutes, and the heat turned off. Following this, the hydrogen gas flow is contained and the furnace removed from the base. The retort is then cooled to 300 degrees F., again purged with nitrogen, and the parts removed.

At this point, all brazed joints are inspected and checked for accuracy. The side connections must be located within plus or minus 0.010 inch, and the inlet connection within plus or minus 0.030 inch. Final inspection and a hydraulic test, using a pressure in excess of 4000 psi, complete

the procedure.

An alloy-steel assembly made up of sixteen separate components copper-brazed into a single unit is shown in Fig. 17. The unit, called a carrier assembly, is designed especially for brazing and consists of two machined sleeves, a casting, a forged ring, and twelve exterior tubes. Assembly is done after all parts have been thoroughly in-

Fig. 16. Copper brazed hydraulic manifold mass-produced for a missile application. Tolerances are close and difficult to maintain because the thin-wall stainless-steel tubes are joined to parts of much heavier mass.

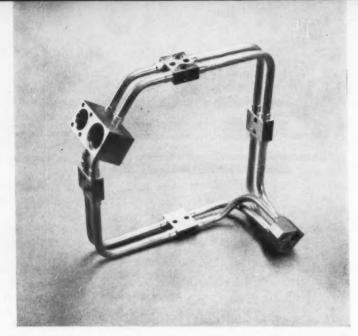


Fig. 17. Sixteen separate components are furnaced-brazed with copper to form this assembly. Interference fits are used to obtain maximum strength.



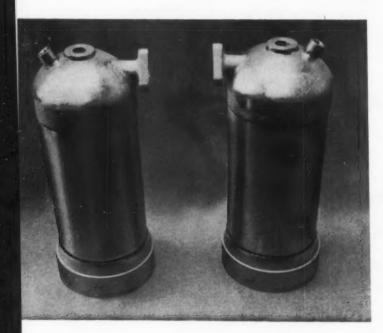


Fig. 18. High-pressure tanks made of components joined by furnace brazing in a hydrogen atmosphere, using a copper-paste filler. The parts are tack-welded in position prior to brazing.

Fig. 19. (Right) This air-conditioner impeller for use in aircraft is furnace-brazed. A fixture applies a load on each vane to maintain metal-to-metal joint contact during bonding.

Fig. 20. (Right, below) Automotive torque converter that has been repaired by brazing in an exothermic furnace atmosphere. Copper-paste filler was used.

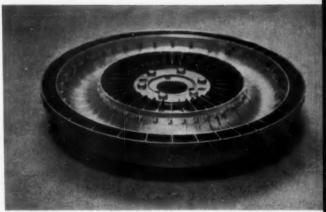
spected and cleaned. The brazing alloy is applied during assembly. For maximum strength, the sections are all designed with interference fits. The exterior tubes are checked for position prior to bonding, which is accomplished in a continuous-operating type furnace under a protective atmosphere.

Final inspection consists of visual checking for 100 per cent alloy penetration and flow. Since the assembly has many internal passages, the copper penetration must be limited to the joint area.

High-pressure tanks utilized in the missile industry are shown in Fig. 18. The top and bottom flange assemblies and head are made of cast alloy steel, connected by AISI 4130 steel tubing. The castings are assembled to the tubing and Heliarc tacked-welded to obtain accurate positioning. After a copper-paste filler is applied on the exterior joint areas and allowed to dry, the parts are brazed in a hydrogen atmosphere. This prevents any decarburization during the process. Inspection again consists of visual examination for 100 per cent penertation of the filler. Since the filler metal in the upper joint must penetrate upward approximately 1 1/2 inches, close joint tolerances must be achieved. Prior to acceptance, the parts are heat-treated and proof-tested in excess of

The copper-brazed assembly shown in Fig. 19 is an air-conditioner impeller employed in a commercial aircraft application. Each vane must be absolutely true on the brazing edge and carefully





positioned to maintain the metal-to-metal contact required. Tight fits are assured by using fixtures that apply a load on the vanes. The materials are mild steel and the furnace atmosphere is exothermic.

A standard automotive torque converter repaired by brazing is illustrated in Fig. 20. Used torque converters normally wear on the internal vanes, allowing a great deal of slippage and bypassing of the fluid. In repairing these units, a copper alloy is applied at all the joint areas in a



Fig. 21. Assembly (left) furnace-brazed with a hightemperature nickel alloy and machined casting (right) are stainless-steel bodies for aircraft valves having identical temperature and pressure-service capabilities. Brazed body weighs 40 per cent less,

MACHINERY'S REFERENCE SECTION

paste form. Paste filler is normally a nonsettling suspension of metal or refractory metal oxides in a liquid. The copper in the paste used in this case was electrolytic powder having a surface oxide contamination of less than 0.4 per cent by weight and is marketed by the Western Carbide Division of Superweld Corporation under the trademark "Liquid Wire." After the paste has been allowed to dry, the torque converter is brazed in a conveyor type furnace using an exorthermic atmosphere. The heat-treated spline shaft is removed during the brazing operation.

Two butterfly-valve bodies, manufactured by Pneu-Tech Laboratories, Inc., Inglewood, Calif., for use in aircraft and missile hot-air systems, illustrate some advantages obtainable through the use of furnace-brazing techniques. Both valve bodies, shown in Fig. 21, are made of stainless steel and are physically interchangeable with each other. The valve seen at the right is a machined casting, and the other is fabricated from

machined bar stock and furnace-brazed, using a high-temperature nickel filler alloy, into an integral assembly.

Although the valve bodies have identical environmental and service capabilities (900 degrees F. and pressures up to 300 psig), the furnace-brazed valve weighs 40 percent less than the cast unit after finish machining, an extremely important consideration in the aircraft and missile industries. The fabricating of valves by brazing has been found particularly economical for short-run production and where quick deliveries are required.

Furnace-brazed coaxial hot-air valves (Fig. 22) have been designed and manufactured by the same company for use in aircraft. Air passing through these self-operating type units actuates the valve gates. They are constructed of spinnings and machined parts of stainless steel, furnace-brazed with nickel filler alloy into subassemblies. The valves are used in service at operating tem-



Fig. 22. These coaxial hot-air valves for aircraft are made of stainless-steel spinnings and machined parts joined by nickel-alloy brazing. Nickel-brazed valves have been service-tested above 1200 degrees F.

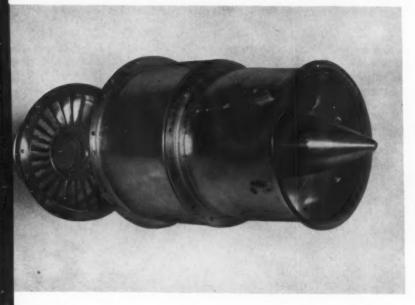
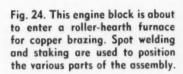
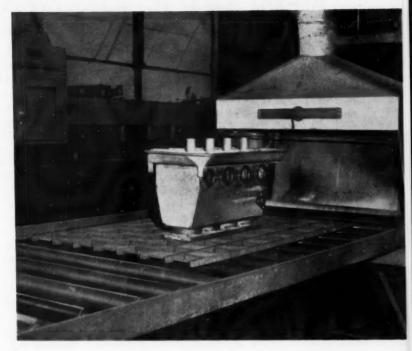


Fig. 23. Castings and other stainless steel components are joined by a combination of welding and nickel-alloy brazing to produce this gas-turbine assembly.





peratures of 900 degrees F. and at pressures up to 300 psig. Other valves furnace-brazed with nickel filler alloys have been service-tested at temperatures in excess of 1200 degrees F.

A gas-turbine assembly composed of stainlesssteel castings and fabricated components joined by a combination of welding and nickel-alloy brazing is shown in Fig. 23. Assembly of the brazed sections requires accurate positioning by Heliarc tacking of all joints. For this high-temperature application, AMS 4775 nickel-alloy filler is employed, and brazing is done in sealed retorts containing a hydrogen atmosphere having a dew point of minus 100 degrees F. or below. The final inspection is by the visual examination of all joint areas for complete penetration.

In a recent development, the Tyce Engineering Corporation, Chula Vista, Calif., is making a racing engine for automotive and marine applications with the entire block (Fig. 24) fabricated from sheet steel by copper brazing. Cylinder liners and the valve and head assemblies are in place prior to the operation. Spot welding and staking hold the various components in position during the brazing cycle. Finish grinding of the cylinders, head plates, and valve guides is done after brazing.

The engine block is made in two types, one of mild steel and the other of stainless steel. Whereas an exothermic atmosphere is used in brazing the mild-steel assembly, hydrogen atmosphere is used for the stainless-steel block. Careful control of the heating rate is necessary in order to reduce the possibility of producing gaps or voids that would be difficult to fill with the brazing alloy. In some cases, the entire block assembly is copperplated and additional filler wire is used to insure that all joints are completely sealed. Precise control over the amount of filler employed in this application is important.

NEW BOOK ON GEAR DESIGN

DESIGN OF WORM AND SPIRAL GEARS. By Earle Buckingham and Henry H. Ryffel. 464 pages, 6 by 9 inches, 160 illustrations. Published by The Industrial Press, 93 Worth St., New York 13, N. Y. Price, \$15.

This text does not present the conventional practices for the design of worm-gear drives; these are already covered in a variety of texts on machine design, handbooks, and the catalogues of gear manufacturers. The aim of the authors has been to show how to obtain the benefits of improved design in spiral gears (crossed-axis helical gears) and worm drives through the use of all-recess-action design principles.

The book does two jobs: (1) It provides a step-by-step guide to the design of worm- and spiral-gear drives with all-recess action, and (2) it presents certain basic principles and practices which enter into the successful design and manufacture of gears and gear drives of all types.

The introductory chapter discusses the nature of the action involved in screw gearing, the attendant contact conditions, how all-recess-action design concepts can improve load-carrying and life capacity, and other "facts of life" about worm- and spiral-gear drives.

In Chapters 2, 3, and 4 the proportions and dimensions for several series of shell and integral worms of 14 1/2-, 20-, and 25-degree pressure angles are determined and the results tabulated for future use and reference. Observations based on long experience of the authors, together with the various examples that are worked out step by step, sharpen the reader's judgment of what to do and what not to do in spiral- and wormgear design.

Chapter 5 investigates some of the conditions that must be met in the selection and design of worms for specific applications, and provides methods for developing a practical series of speed-reducing worm drives complete with tables.

Chapters 6 and 7 detail the design of reduction drives and step-up drives of high efficiency, and give tables of worms for various numbers of starts for reference and selection. A too-often neglected area of gear design involves the gear-drive housing, with its attendant problems of assembly, lubrication, sealing, cooling, gear-blank design, provisions for interchangeability, adjustment, etc. This phase of the over-all design of a gear drive is explained and illustrated in detailed diagrams that can be used as a basis for working drawings.

Chapter 8 shows how to design diametral-pitch worms for small reduction ratios using the same commercial hobs as for spur and helical gears.

Chapter 9, on the design and use of spiral gears, analyzes the contact on these little-understood and relatively inexpensive-to-manufacture drive elements. Of

particular interest is the description of how to make the necessary contact diagrams for these gears and how to evaluate safe loads.

Chapter 10 covers fine-pitch worm- and spiral-gear drives, and in an unusual case of spiral gear-tooth action, the authors design a worm- and spur-gear reduction drive. In other examples, the design of fine-pitch worms for indexing and accurate positioning is described in detail, including the setup of the hobbing machine and the selection of cutters. Of particular interest to instrument designers will be the section showing how screw threads may be used as worms, and taps as hobs, for producing fine-pitch drives for numerous applications.

Chapters 11 and 12 show in great detail how graphical methods are used to determine contact conditions on spiral and worm drives that are based on the use of both the screw-helicoid thread form and the involute-helicoid form. In addition to these graphical methods, step-by-step algebraic solutions that may be used instead of the graphical methods are given, as well as simplified calculation forms that considerably reduce the work.

Lubrication, friction, and wear are examined in Chapter 13 to show how these factors are related with regard to all-recess-action drives.

Chapters 14 through 17 show how beam strength, limiting loads for wear, and dynamic loads on spiral and worm gears are evaluated. In particular, the effect of the masses of the rotating gears—including the effect of connected parts such as shafts—is evaluated with regard to the dynamic loads. The use of "torsion bars" to lessen impact loads due to connected masses is also shown.

The formulas, diagrams, and methods needed to solve bearing-load problems are developed in Chapter 18, and in Chapters 19 and 20 a complete and comprehensive problem is worked out for both spiral- and worm-gear drives. In the chapter covering the complete design of a spiral-gear drive there is given a method whereby, using the principles of geometric similarity, almost any initial design may be reproportioned to provide the requisite load-carrying capacity and life.

The complete list of chapter titles is as follows: Introduction: Worm Gear Geometry, Contact Conditions and Nature of Action; 14 1/2-Degree Linear Pitch Worms; 20-Degree Linear Pitch Worms; 25-Degree Linear Pitch Worms; Selection and Design of Worms; Design of Reduction Drives; Design of Worms for Step-Up Drives; Diametral Pitch Worms; Design of Spiral Gears; Fine Pitch Worm and Spiral Gears; Contact Analysis, Screw Helicoid; Contact Analysis, Involute Helicoid; Lubrication, Friction and Wear; Dynamic Loads on Spiral Gears; Dynamic Loads on Worm Gear Drives; Beam Strength of Teeth; Limiting Wear Loads for Spiral and Worm Gears; Tooth and Bearing Loads; Analytical Design of a Worm Gear Drive; Analytical Design of a Spiral Gear Drive.

TOOL ENGINEERING

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Adjustable Center Designed for Use in Headstock Spindle of Turret Lathes

ROGER ISETTS, Kenosha, Wis.

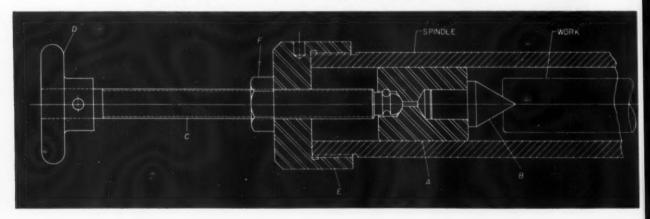
In turret lathe operations it is sometimes desirable to support one end of the work on a center mounted in the headstock spindle, and to take the cuts on the part as close to the spindle as possible so as to insure maximum rigidity and size control. In cases where the cuts are taken at a considerable distance from the end of the work, some method of extending this work end into the spindle and supporting it on an internal center would greatly facilitate the operation.

Illustrated is a simply constructed adjustable type center unit designed specifically for this purpose. It will handle a large variety of work and hold parts with extreme accuracy. The unit consists primarily of a cylindrical steel plug A which is machined to a slip fit in the spindle. One end of the plug is reamed to provide a press fit for the shank of a hardened center B. The other end is drilled to receive the ball-socket end of screw C.

This screw can be made to any required length and is supplied with a handwheel D at the outer end. The screw engages a tapped hole in round cap E which serves to attach the unit to the outer end of the headstock spindle. By turning the handwheel, plug A with center B may be adjusted longitudinally within the spindle to suit the work. An internal thread in cap E fits the rear end of the headstock spindle.

In attaching this adjustable center unit to a machine, the rear cap of the headstock spindle is first removed; then the center unit is slid into the spindle and cap *E* tightened against the end of the spindle. After the end of the work is entered into the headstock spindle in loading work into the turret lathe, the adjusting screw is advanced to position center *B* for supporting the work firmly. Lock-nut *F* is then tightened against cap *E* to hold the unit securely in place.

Adjustable center unit designed for holding work inserted into the end of the headstock spindle on turret lathes when cuts are to be taken close to spindle.



Keyslotting Tool for Extra-Large Castings

CHRIS J. TOONEN, Green Bay, Wis.

In the shop where the writer is employed, it is frequently necessary to cut keyways in castings so large that a conventional keyseater is impractical for the job. For work of this character a special tool was designed that is applied on radial drilling machines. A circular keyseating cutter is rotated by the drilling-machine spindle, and the entire unit is fed down through the work by conventional means.

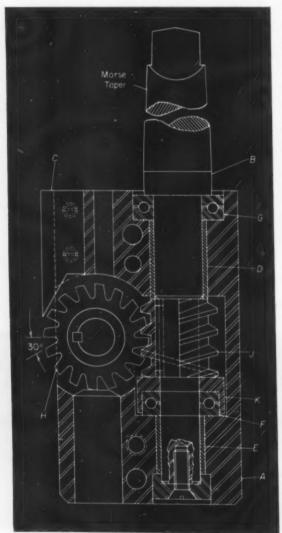
Referring to the illustration, body A is turned from AISI 1020 steel, to a diameter of 4.749 inches. In the case of the particular tool shown, body diameter is about 0.003 inch smaller than the hole in the casting. The body B is kept from rotating during operation by a hardened tool-

steel guide C. The one-piece shaft turns in bronze bushings D and E. Thrust is taken by ball bearings F and G.

The keyway for which this tool is built is 0.750 inch wide by 0.375 inch deep. Cutter H, made of hardened and ground high-speed steel, is carried on a tool-steel shaft. The shaft is so located in the body that the cutter protrudes beyond the body the distance necessary to cut a slot of the correct depth. The cutter has sixteen teeth machined to a 15-degree helix angle. The cutter teeth themselves mesh with a worm J, for driving purposes, as shown.

The worm is also made of high-speed steel and hardened and ground. It has a two-start thread and drives the cutter from the back of the teeth. Cap *K* prevents chips from entering the lower thrust bearing and transmits end thrust from the worm to the lower ball bearing. Infeed thrust is taken by the top ball bearing. Before hardening, the worm and the cutter are tried together for fit.

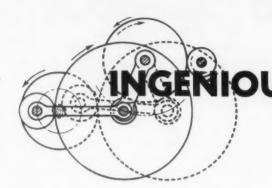
Stock removal in the keyslot is accomplished by the climb-milling method. Provision is made in the body for a generous flow of coolant so that chips are flushed away before they can get into the worm gearing and bearings. The shaft is drilled in line with its center for oil lubrication of bearings *E* and *D*. Auxiliary holes lead to the bearings. These bearings have grooves on their inside-diameter surfaces to distribute oil. The shaft oil hole leads to a radial filler hole on the shank of the driving shaft between the top bearing shoulder and the blend area of the Morse taper shank.



American Standard Requirements for Instrument Precision Ball Bearings

A newly revised publication, American Standard Requirements for Instrument Precision Ball Bearings, B3.10-1960, has been approved and published by the American Standards Association, 10 E. 40 St., New York 16, N. Y. This revision supersedes American Standard B3.10-1959, and redefines the characteristics of instrument precision ball bearings.

Worm (J) on shaft (B) is turned by a radial drill to drive milling cutter (H) as though it were a worm-wheel. The cutter will cut a keyslot in big bores of castings too large or too cumbersome to be handled by standard keyslotting machinery.



OUS MECHANISMS

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Tape Reel Has Quick Action and Constant Gripping Pressure

G. G. HERZL, Palo Alto, Calif.

Tapes used in programming machine tools and in other operations are wound on spools, which, in turn, are positioned on a reel. Tapes and spools are made in different widths, but the spools necessarily have the same inside diameter.

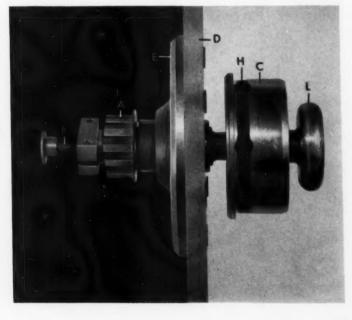
To grip the spool, most reel designs involve the tightening of a cap-nut on a thread which is part of the reel spindle. The nut presses against a rubber cylinder which expands in the bore of the spool, securing it to the reel. Disadvantages of such action are that engagement and disengagement time is relatively long; the firmness of the grip depends on how much the cap-nut is tightened, which might vary from operator to operator; and some of the components of the reel have

to be changed whenever the spool width is changed. An added shortcoming is that the clutching action can only be performed manually, and cannot be made automatic.

On the hand, the reel design proposed in Fig. 1 is quick acting, assures a constant gripping pressure, accommodates spools of different width without adaptation, and can be readily converted to operation by a solenoid. A cross-section drawing appears in Fig. 2. Details visible in both illustrations are lettered similarly.

The device is driven by a motor through a timing belt (not shown) running around pulley A feathered to shaft B. Hub C is pressed on the shaft, which extends through frame D of the

Fig. 1. When a tape spool is positioned on hub
 (C), a thrust of knob (L) causes rubber ring
 (H) to be parily displaced from its neck.



transport unit or machine control cabinet. Flange E bolted to the frame is lined with a bearing which supports the shaft. This bearing extends through the bore of the hub. The portion of the shaft which runs through the hub has a tapered surface E and an annular groove E.

Rubber ring H is a snug fit in a neck in the hub. Pressure is exerted around the hub by the ring, since the inside diameter of the ring is smaller than the diameter of the neck. There are six counterboard holes equally spaced radially in the neck, each containing a dowel-pin J and steel ball K. The rubber ring keeps the balls and pins in pressure contact with shaft B.

Reel spools are a slip fit over hub C. To position a spool on the reel, knob L, pinned to the shaft, is pulled to the right, and the rubber ring forces the balls and dowel-pins down radially on taper F. Since the rubber ring is now completely contained within its neck, the spool is able to slip over it.

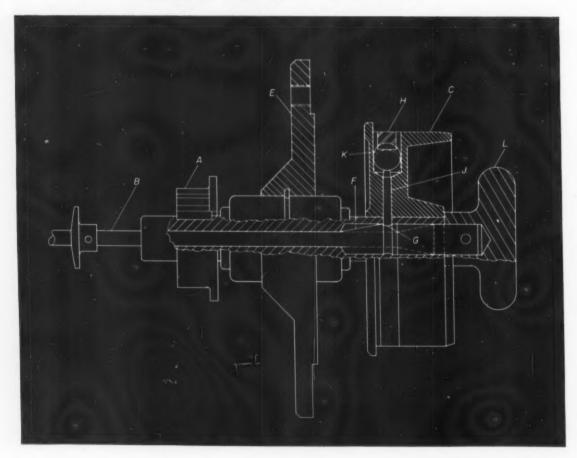
To grip the spool, the knob is thrust to the left, the dowel-pins being forced out by the taper,

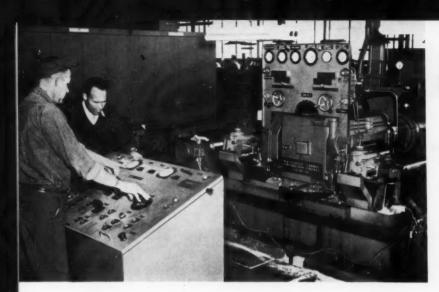
settling in groove G in the shaft. (This is the position illustrated in Fig. 2.) Simultaneously, the balls move out radially, partly displacing the rubber ring in the neck. The displaced rubber fills the clearance between the outside of the hub and the inside of the spool, and is sufficient to exert a firm grip on the spool. This grip remains constant from spool to spool, since it is outside the control of the operator.

Total radial movement of the dowel-pins is calculated so that the volume of the penetration of the balls in the rubber equals the clearance area. Relatively large tolerances are permissible, because of the compressibility of the rubber, which takes up the variations.

It is possible to connect the left end of shaft *B* to a two-directional solenoid for automatic operation. The solenoid has to be actuated only when a spool is being positioned or removed. A micro switch can be used to sense the axial position of the shaft, and the machine can be wired in series with the micro switch so that it will not start if the spool is not firmly gripped.

Fig. 2. With ball (K) up (solid line), part of rubber ring (H) is displaced; with ball down (broken line), all of rubber ring is contained in neck of hub (C).





From the control console, Techalloy's president David Schmid (right) and vice-president Ralph Cubbler put the Sendzimir mill through shakedown run.

REROLLER ADOPTS VACUUM ANNEALING

AN ENERGETIC two-man team, starting from scratch just seven short years ago, has put together an alloy wire and strip rerolling plant which today claims these distinctions:

It is the largest redrawer of stainless-steel wire in the country;

It is the nation's largest producer of nickelalloy wire and strip;

It is fourth in the booming electrical resistance wire field.

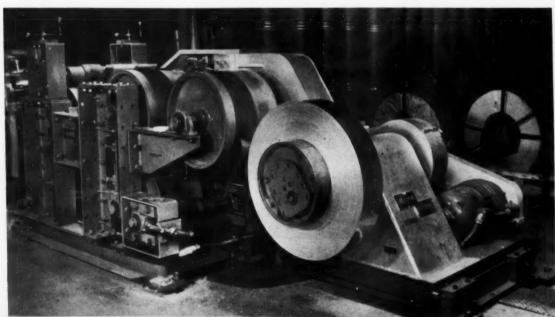
The firm, Techalloy Co., Inc., Rahns, Pa., has grown from 8000 square feet to 80,000 square feet. From an initial outlay of \$25,000 in 1954, wire and strip equipment is now valued above \$2,000,000—and all of it was acquired without outside financing. Last year, a second plant was built at Union, Ill., to serve the Midwest.

One of the newest pieces of equipment is a Sendzimir mill, which—like all other machinery operating at Techalloy—was rigged, wired, and plumbed by company personnel. A feature of the new mill is that coolant reservoirs are located outside the building, rather than underground.

Soon to be placed in operation is a unique vacuum-annealing system. At present, the company uses cracked ammonia or reducing gas in its annealing practice, as do other rerollers. Increasing demands for even purer products will be met by the vacuum annealing. Pot walls of the new system are 1/8 inch thick, not the customary 3/4 inch, saving metal and requiring considerably less fuel because of the thinner section. To prevent pot distortion from so thin a wall, a vacuum is pulled both inside and outside the pot.

Take-up auxiliary polishes stainless-steel and high-nickel strip leaving annealing furnace.

Coil is wound on drum driven by a variable-speed motor, to maintain a constant surface speed through the furnace.



LATEST DEVELOPMENTS

Machine tools, unit mechanisms, machine parts, and

Monarch Profile-Tracer and Variable-Speed Lathes

A 612 rotary profile-tracer lathe, developed primarily for the boring of bottle molds having noncircular cross sections, has been brought out by the Monarch Machine Tool Co., Sidney, Ohio. Other applications of this lathe, Fig. 1, include the machining of plastic molds, aircraft parts, cams, and rotors. The chief performance characteristics are speed of operation and accurate reproduction. A major feature is the Monarch superprecision electrohydraulic tracer, the head of which is built into a bar that is adjustably mounted at the front of the cross-slide. Stylus deflection pressure is only 1 1/2 ounces. Electrical amplification of stylus movement instantly translates the slightest work-contour change into hydraulic slide movement. Accuracy of reproduction is such that later hand-finishing operations are often eliminated.

The maximum tracer-slide stroke at one setting is 4 inches. Tool adjustment for diameter is by means of a slide mounted between the tracer-slide and the swiveling toolslide. The latter is set parallel to the work axis for length adjustment of the tool. The cross-slide is provided with automatic pressure lubrication. For convenience of setup and operation, the master spindle is located at the front of the machine. There is a positive gear drive from the headstock spindle through a quadrantmounted idler, which may be adjusted to remove all backlash between the lathe spindle and the master. A timing device on the master spindle is provided for angularly positioning the master mold and work-piece.

A female or male master can be used. With the master spindle locked or held stationary, a half mold or a conventional flat template may be used to guide the tool for boring or turning. Because of the light stylus pressure, non-metallic materials may be used as masters. Since this rotary profile-tracing machine is basically a

Monarch 612 lathe, it can be used also for conventional lathe work.

The Monarch Series EE, Model 1000 machine shown in Fig. 2 is a versatile, 15-hp precision lathe which is equally suitable for manufacturing or for toolroom use. It swings 16 inches over the bed, 8 3/4 inches over the cross-slide, and is offered in 30- and 54-inch center-distance capacities. Infinitely variable speeds, forward or reverse, may be secured between 20 and 2000 rpm. There are four ranges; the first three being geared and the other direct through the multiple V-belt drive. All gearing is idle when the direct high-speed range is engaged. The precision ball - bearing - mounted spindle has an American standard 6-inch D-1 Camlock nose.

Speed control is all-electric, while the shift itself is hydraulically actuated. A selector switch at the apron provides the desired speed range, and a nearby control knob selects any speed within the range. In plain view of the opera-

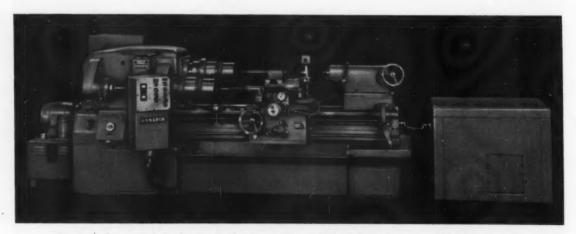


Fig. 1. Profile-tracer lathe for noncircular cross-section work brought out by Monarch Machine Tool Co.

IN

SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by Freeman C. Duston

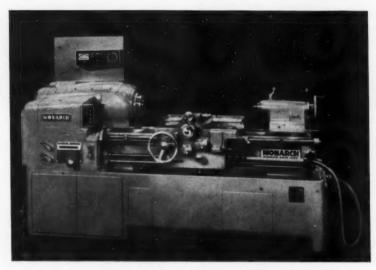


Fig. 2. Monarch Series EE, Model 1000 variable-speed precision lathe equipped with push-button control

tor is a tachometer which shows continuously the speed at which the spindle is operating. Up to four speeds may be preset in any one range by means of potentiometer control and made operative as required during the turning cycle by depressing push buttons.

The direct main-drive motor secures its power through an electronic conversion unit. Vibration and noise are minimized by the absence of revolving equipment in the power-supply unit.

The control cabinet has two compartments. One contains the electronic elements and is forceventilated; the other is a dust-tight compartment which houses the relays and starters. Spindle-motor electronics, in the form of a plug-in module for ease of maintenance, consist of only five tubes along with silicon diodes and other static types of electrical components. A spindle load meter is provided to show at all times whether

the lathe is being operated at peak capacity.

Gear-box and end gearing are totally enclosed. The end-gear train carries a fixed-center quadrant which facilitates changes of gearing for chasing odd leads or the substitution of Metric end gearing. The gear-box has a range of sixty-six threads and feeds. The apron is furnished with four-way power rapid traverse. Apron-controlled lead-screw reverse is also provided, the lead-screw being used only when threading. Both the cross-feed screw and compound screw are induction hardened and precision ground. The tailstock is of the quick-clamping

Bedways for both the carriage and tailstock are flame-hardened and precision ground. Lubrication throughout the machine is automatic. There is a combined mist and liquid system in the headstock.

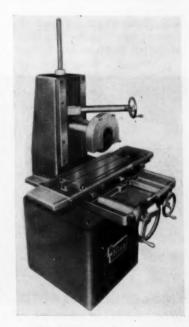
Circle 565 on Readers' Service Card

Low-Cost Surface Grinder

The King Machine & Mfg. Co., Los Angeles, Calif., is marketing a low-cost, manual-control precision surface grinder, Model K-1020. This machine has a longitudinal table travel of 20 inches, a 14-inch cross-feed, and can be used for either wet or dry grinding. The grinding-wheel diameter of 12 inches allows a 15-inch vertical clearance over the table. The T-slotted table travels on precision-ground ways and has adjustable table stops. It features a 10by 20-inch surface when used for wet grinding.

The grinder has a direct-drive spindle, rotating on preloaded precision ball bearings and powered by a 1 1/2-hp balanced motor. Magnetic chucks and other accessories are also available for this machine.

Circle 566 on Readers' Service Card



King low-cost surface grinder

Cone-Drive Worm-Gear Reducer that Develops 8,600,000-Inch-Pound Torque

A 1000-to-1 ratio, Cone-Drive double-enveloping worm-gear reducer developing a torque of 8,600,000 inch-pounds has been built by Cone-Drive Gears, Division Michigan Tool Co., Detroit, Mich., 'This giant-size gear-reducer unit is installed in the hopper-boom dredge "Zulia" built by National Bulk Carriers, Inc., in their Kure, Japan, shipyards. The Cone-Drive gear reducer is used in the drive which rotates a 328foot movable discharge boom mounted amidships of the Zulia. The boom, containing a 57-inch diameter pipe, is rotated through an angle of 180 degrees. When swung at right angles to the ship. the boom extends its full length past the vessel's hull and can discharge waste beyond the limits of the channel being dredged.

The Cone-Drive reducer assembly consists of two primary reducers of 20-to-1 ratio, 18-inch center distance, and one secondary reducer at 50-to-1 ratio with 44-inch center distance, giving a total reduction of 1000 to 1. Two electric motors totaling 273 hp drive the primaries at 1150 rpm to result in an output torque of 9,500,000 inch-pounds from the speed reducer. Overload capacity of the system is sufficient to produce 22,500,000 inch-pounds in an emergency situation. The vertical output shaft of the reducer chain-drives a giant pulley, approximately 80 feet in diameter, on the rotating base of the boom.

Circle 567 on Readers' Service Card

Tri-Matic Oscillating Sheet-Surfacing Machine

The Sales Service Mfg. Co., St. Paul, Minn., has brought out a Tri-Matic oscillating sheet surfacer developed for fast, efficient operations ranging from cleaning and preparing sheet metals for drawing to graining and polishing practically any sheet material. This machine employs abrasiveimpregnated nylon mounted on an arbor which can be adjusted to oscillate from 0 to 400 times per minute. The work-head drive can be equipped for single or variable speed, and the feed rolls are provided with variable-speed drive. The work pressure is positively controlled and electrically metered to facilitate maintaining a constant pressure as the workhead wears.

The combination of variable speed, feed, work pressure, and oscillation is said to provide unusual flexibility that makes it easy to obtain the best combination for any surfacing operation on practically any sheet material. The work can be supported by a billy roll that is stationary or electrically timed and of either the idler type or powered, or by a powered con-

veyor. The machine may be used singly or incorporated in a conveyor line and can be furnished for either dry or wet operation. It is available with practically any length work-head from 48 inches up and with multiple heads on the same work conveyor. The work-head arbor can be loaded with abrasive-impregnated nylon material to any width up to maximum.

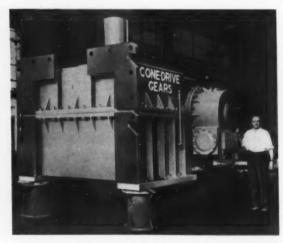
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Norton Abrasive for Precision Grinding

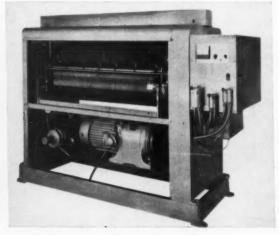
The Norton Co., Worcester, Mass., has announced the development of a new abrasive for precision grinding. This 23 Alundum abrasive grain, intended especially for such precision grinding operations as surfacing with abrasive segments, combines the friable, free-cutting characteristics of Norton's 32 and the durability of its 57 Alundum abrasives.

The new 23 Alundum grain is the result of a two-year research project undertaken to find ways of cutting costs in segment grinding. Field-test reports have shown that segments made from the new abrasive grind more pieces per dressing with less tendency to burn and give longer life than previous segments used for the same operations. Investigations are now under way to determine other areas of application where 23 Alundum abrasive can reduce grinding costs.

Circle 569 on Readers' Service Card



Worm-gear reducer unit of exceptional torque capacity built by Cone-Drive Gears, Division Michigan Tool Co.



Tri-Matic sheet-surfacing machine of oscillating type brought out by the Sales Service Mfg. Co.

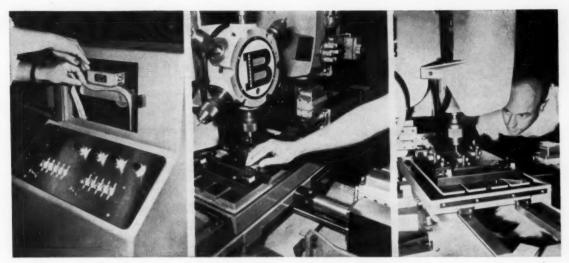


Fig. 1. (Left) Tape-reading console of Moog "Hydra-Point" machine table control system. (Center) Work-piece being placed on table of Burgmaster drill press equipped with Hydra-Point Control. (Right) Operator watches as hydraulic pistons position table for drilling.

Moog "Hydra-Point" Tape Control System

A pneumatic-hydraulic, pointto-point tape control system, called the Moog "Hydra-Point," designed for automatic positioning of machine tool tables, has been introduced by Moog Servocontrols, Inc., East Aurora, N. Y. This system was developed to sell within the budget range of small manufacturers. As applied to the automatic control of a Burgmaster drill press, it uses a tape-reading console into which a continuous tape punched with the machining instruction program is inserted, as shown at the left in Fig. 1. The blank part or work-piece is placed on the drill press table prior to automatic machining as indicated in the center view, Fig. 1. In the view to the right, the operator is shown observing the work as the hydraulic pistons (rear and lower right) accurately position the table for the first drilling operation.

Each axis of the positioner employs a hydraulic positioning servo that is basically similar to the "tracer" servo shown in View 1, Fig. 2. In this arrangement, the machine work-table is moved by a hydraulic actuator. The actuator operating pressure, P₁ is controlled by a three-way servovalve. When the valve control port is opened to supply pressure, the piston is

driven outward. Conversely, when the control port is opened for the return movement, the piston is retracted by pressure acting on the area A_2 . When the valve spool land is nulled-exactly centeredon the port, pressure P1 becomes equal to one-half the supply pressure P. The piston will then come to rest, since piston area A1 is equal to twice that of area A_2 . Thus, with the valve spool connected to the work-table, a "followup" servo is formed so that if the valve porting sleeve is moved, the table will accurately duplicate its movements.

If a means were provided whereby the valve control port could be selectively moved to a number of discrete positions, it could form the basis for a numerical positioning system. View 2, Fig. 2, shows such an arrangement. By means of a multiposition selector valve, the valve control port is effectively moved to any one of a number of identical ports in the valve body. This arrangement will function to feed hydraulic oil to the cylinder so that the table will move to the position where the valve spool land is nulled on the port that is connected to the cylinder by the selector valve.

The absolute positioning accuracy of this servo is basically determined by the location accuracy of the selectable valve port holes, which serve as fixed gage points. These holes can be located within 0.001 inch. Furthermore, by closely controlling the port hole size so that the diameter of any hole very nearly matches the valve land width, the valve can be made to control cylinder pressure over its full range for extremely small motions. Therefore, whenever any given port hole is selected, the servo will always repeat that position of the table within a few ten thousandths of an inch-even under maximum work-table friction loads.

The mechanism described embodies the basic principle of the Moog numerical positioner. However, in order to make a practical positioner, it is necessary to provide for selection of any dimension in 0.001 inch increments, without the use of an unreasonable number of gage point holes. Also, a selector valve must be provided which can be simply operated from punched tape.

The first requirement is met by using gage point holes located every 0.100 inch and interpolating between them by means of a helical valve land. The valve land will therefore act as a single turn mi-

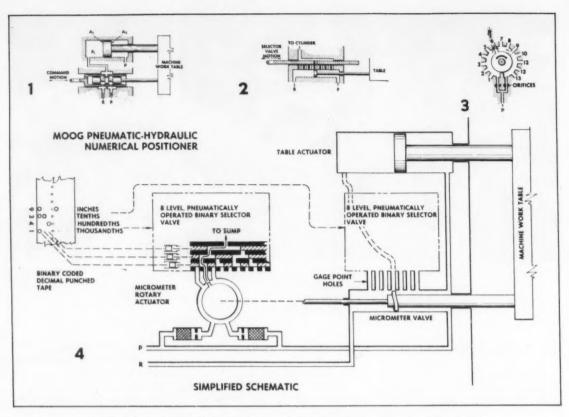


Fig. 2. Diagrams illustrating operation of Moog Hydra-Point system for automatically positioning tables of metalworking machines by tape control

crometer screw. Each of one hundred incremental angular positions of the valve advances the effective gaging point by 0.001 inch.

Rotation of the valve land is accomplished by a vane type rotary actuator. (Shown in simplified form in View 3, Fig. 2.) Angular position of the vane is controlled in a manner basically similar to the technique used in selecting the axial gage point holes. A multiposition selector valve is used to connect any one of the hundred holes located in the rotary actuator faceplate to the return pressure line. As the cavities on both sides of the rotary vane are supplied with pressure oil, through pressure dropping orifices, the vane moves until it is centered over the selected holes. Both the linear and rotary selector valves are formed by stacks of two-position, multiport, sliding-plate elements. The number of plate elements used in each case depends upon the number of discrete combinations required. For a 10-inch stroke actuator both selector valves must provide at least one hundred combinations; and accordingly, eight plate elements are used in each valve. The linear selector valve must be capable of establishing a gage point corresponding to the inches and tenths of an inch of the desired position. Similarly, the rotary actuator must assume an angular position corresponding to the hundredths and thousandths of an inch of the desired position. The position of each plate corresponds to the presence or absence of a hole in the punched tape as determined by a pneumatic block tape reader. Position information is stored in binary coded decimal form on 1-inch eight-channel punched tape.

The combination of all the previously described elements to form the complete positioning system is shown in the simplified schematic View 4, Fig. 2.

Fully automatic machine positioning is accomplished in the following sequence. Pushing the "Cycle Start" button on the control console causes an electromotor-driven Geneva mechanism to bring the first block of punched tape into position in the tape reader. A sequence cam then applies air pressure to position the selector valves in accordance with the tape punching. When the valves have been positioned, hydraulic pressure is applied to drive the table actuators to the required positions. When table motion stops, hydraulic pressure is removed from the table actuators and air pressure is applied to table clamps. This air pressure also closes an electrical contactor to initiate tool feed. Pneumatically operated switches, activated from the tape reader, control the machine's tool, coolant, and feed selection system. Retraction of the tool at the completion of each operation restarts the positioning

Semiautomatic and manual modes of operation may also be selected by a switch on the control panel. The semiautomatic mode is intended for use during tool setup and provides for manual initiation of machine operation.

In manual-mode operation, no tape is used in the reader. Instead, the operator may set the table position by means of dials on the control console. Tool selection and feed then revert to the machine control panel.

The Industrial Division of Moog Servocontrols includes in its list of electrohydraulic servomechanism applications for tracing systems: memory access systems for large computers; printing press steering and registration controls; and automatic welding machine controls; as well as tapecontrolled machine tool drives.

Circle 570 on Readers' Service Card

Automated Tapping Unit

An automated tapping unit that utilizes the "lead-screw" principle is being made by the Thriftmaster Products Corporation, Lancaster, Pa. Pitch changing with the one rugged leadscrew assures highly accurate threads and results in substantial savings in time and production costs. The use of a rugged durable "coarse pitch" ground Acme thread lead-screw and nut reduces the effect of wear. Tapping pitch is changed by replacing only one gear at the back of the unit. This requires less than ten minutes.

The unit is completely self-contained and may be mounted in any position from vertical to horizontal. An oil pump provides circulating oil lubrication to all bearings and gears. All rotating parts are mounted on ball bearings, and the guide rods operate in ball bushings instead of sleeve type bearings. Oversize steel parts are made of fully heat-treated, hard-

ened chromium-molybdenum steel to handle 3- or 5-hp motors.

Safety controls prevent overtravel in either direction and prevent damage if the spindle hits an obstruction. Completely automatic cycle, manual, or jogging operation may be obtained with standard controls. Maximum stroke is 5 inches with a 3-inch rapid approach and 2-inch leadscrew travel. All movements are adjustable and may be correlated for automatic operation. The tapping unit illustrated has a fourspindle, double-eccentric, adjustable tapping-head attached.

Circle 571 on Readers' Service Card

Improved Open-Die Cold-Heading Machine

An improved open-die precision cold-heading machine for making long, thin parts such as lead wires, pins, or rivets has been announced by REM Sales, Inc., a subsidiary of the Robert E. Morris Co., West Hartford, Conn. Fully 50 per cent heavier than the previous model, this machine comes equipped with motor and V-belt drive which makes possible production rates of 60, 90, or 100 pieces per minute on parts up to 2 3/8 inches in

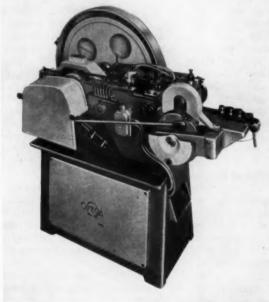
length in a nominal wire-diameter capacity range of 0.020 to 0.090 inch.

The machine is furnished with two sets of straightening rolls—a nine-roll straightener for fine wire up to 0.036 inch in diameter and an auxiliary five-roll straightener for wire sizes of 0.036 to 0.090 inch. A one-shot lubrication system and a set of prototype tools are part of the equipment.

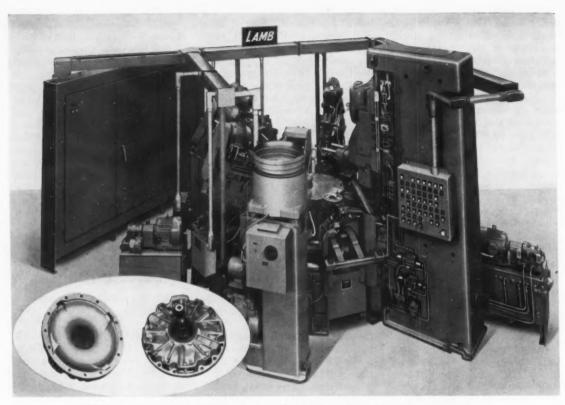
Circle 572 on Readers' Service Card



Automated tapping unit for single-lead-screw design being made by Thriftmaster Products Corporation



Improved open-die precision cold-heading machine announced by REM Sales, Inc.



Ten-station dial index machine built by F. Jos. Lamb Co. combines assembling and machining operations in the production of automotive transmission-case covers

F. Jos. Lamb Dial Index Machine Processes Transmission-Case Cover Assemblies

A ten-station dial index machine designed and built by F. Jos. Lamb Co., Detroit, Mich., combines assembly, drilling, spotfacing, and straddle-milling operations in processing 212 transmission-cover torus assemblies per hour at 100 per cent efficiency. A tilting quill unit lowers a bushing plate into the center hub of the part to obtain tool stability and accuracy in drilling an integral oil hole. The parts are manually loaded at Station 1, with the input shaft down. They are radially located by means of a spring detent that engages a locating hole in the part. A heavy spring-loaded collet clamps the part in the fixture.

The hopper-fed bushings are pressed into the spindle of the part at Station 2. Due to the geometry of the part, a tilting quill unit is used at Station 3. It lowers a bushing plate into the hub of the part to prevent tool

drifting and drills an oil-hole in the outer wall. Then, using the drilled hole as a bushing, a vertical internal wall is spot-faced and drilled through. After turning the part 180 degrees in the fixture, the drill, spot-face, and drill operations are repeated. At Station 9 a straddle-milling operation cuts openings at two sides of the hub into internal cavities of the part. Auxiliary clamping is provided for greater rigidity during this operation.

The machine is composed of standard building-block components mounted to a Lamb standard 48-inch, automatic, cam-actuated indexing table. The fixtures, mounted around the outer diameter of the table, form a center pocket that is covered to keep out chips and coolant. All electric and hydraulic components and piping conform to JIC standards.

Circle 573 on Readers' Service Card

Kennametal Carbide Burnishing Balls

Burnishing and sizing of 11/2inch diameter cylinder bores in aluminum-alloy forgings at a West Coast plant is said to be accomplished at lower cost and higher production rate, and with a better quality of finish, following a change from high-speed steel to carbide sizing balls. Both the high-speed steel and carbide sizing balls were used in a specially designed machine. The carbide balls, furnished by Kennametal Inc., Latrobe, Pa., had served seventyfive times longer than steel balls, according to last reports, and were good for still longer life.

In this operation 14ST aluminum forgings are held in a carbide die or "well" to maintain the outside diameter while a hydraulic ram forces the ball through a 5-inch long bore. A single ball with close dimensional tolerances produces a 1.493- to 1.494-inch bore size and imparts a burnished fin-

ish. The special machine operates with four identical balls cycling in a closed circuit. Production is 375 pieces per hour or 9000 sized and burnished pieces every twenty-four hours. The lubricant used is a soluble oil thinned with kerosene.

Fifty weeks after going into service the carbide balls are still in use. They have sized 2,250,000 pieces. Steel balls, after sizing only 30,000 pieces, were worn undersize and galled badly.

Circle 574 on Readers' Service Card

Mikron Gear Hobber

The latest addition to the Mikron line of fine-pitch gear-hobbing machines, the No. 21, available through Russell, Holbrook & Henderson, Inc., New York City, can be used as a handloaded, semiautomatic, or fully automatic production machine. The change from one type of operation to another requires no machine modifications; only a sim-

ple tooling change is necessary. The automatic loading mechanism is contained in one small casting and can be removed or applied to the machine in a few minutes.

The Mikron No. 21 is completely hydraulic in operation except for the hob and spindle. The hydraulic unit controls infinitely variable feeds, the automatic hob cycle, and the automatic deburring tool. A plunge feed is part of the hob cycle and is also infinitely variable. This eliminates hob approach and is said to increase production rates up to 75 per cent.

Cutter speeds range from 400 to 4800 rpm and feeds from 0 to 0.006 inch per second. A push-button-actuated automatic lubrication system oils all moving parts and sliding surfaces. The maximum work diameter is 1 9/16 inches and the maximum length of cut is 1 9/16 inches. Steel gears up to a maximum of 25 diametral pitch with from 60 to 390 teeth can be cut.

Circle 575 on Readers' Service Card

Band Cutting Machine with Roller-Mounted Table

Straight and accurate cuts can be made quickly by a gliding-table utility band machine recently added to the line of metal-cutting band saws manufactured by the DoALL Co., Des Plaines, Ill. This Model 1612-UGT machine is said to bring the advantages of the larger work-feeding table models to the low-cost utility line; improve the ease and accuracy of straight cutting normally performed on machines of this kind; and adapt them for innumerable fast, light-duty production jobs.

The machine has a 16-inch throat, 12-inch work height, and a work-table 24 by 24 inches mounted on eight antifriction precision rollers. It has 12 inches of manual travel or 8 inches of travel with the weight type power feed attachment. A work stop and mitering attachment are furnished. The table can be locked to permit regular contour cutting.



Mikron hydraulically operated gear-hobbing machine



Glide-table utility band machine introduced by DoALL Co.

Infinitely variable band speeds from 50 to 5200 fpm are available in two ranges. Saw bands from 1/16 to 1/2 inch in width can be used. A 1-hp driving motor is employed. The machine is recommended for a wide range of light maintenance and toolroom work in steel, as well as nonferrous metals, plastics, paper products, and wood.

A butt welder permits the use of bulk saw band. It also permits internal cutting by threading the band through a hole in the work, rewelding, and tensioning it over the wheels and through the guides. The internal cutting is then performed and the band removed. The glide-table utility band machines have job-selector dials that show the operator the best band and band speed for a great variety of materials. Other features include dual-range transmissions, air pumps, chip blowers, and removable chip drawers.

Circle 576 on Readers' Service Card

Red Ring Automatic Loader for Gear Shaving and Honing Machines

A Red Ring automatic loader that accurately gages unsymmetrical parts for size before entry into the input chute is announced by National Broach & Machine Co., Detroit, Mich. This slide type loader, which automatically feeds and unloads parts from rotary gear shaving or gear-tooth honing machines, is adapted to the handling of such parts as transmission clutch gears. The size check at the entrance to the input chute is made by passing the gear on the end of a shaft type part between two master gears.

The Red Ring patented meshing principle is utilized on this new machine. The lower master gear is equipped with radial fingers on which the shaft portion of the gear rests as it is being passed through the gaging master gears. This design avoids part-positioning errors that make it difficult to gage unsymmetrical work.

The loader is operated by an air cylinder that actuates a slide. Parts are automatically fed one at a time at spaced intervals into machining position, clamped between centers, processed in a controlled machining cycle, unclamped, and carried into an exit chute where they roll to the front of the machine for either operator or conveyor pickup. In the application illustrated, the loader han-

dles the 2.196-inch pitch diameter by 8 3/16-inch long clutch gears at a rate of 160 per hour.

Circle 577 on Readers' Service Card

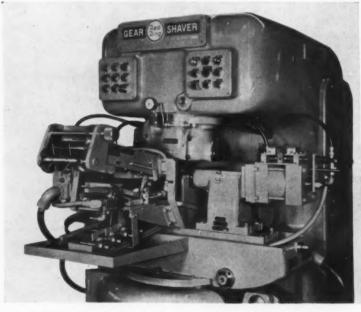
High-Speed Trimming Press with Squeezing Action

A T4C 30-ton, four-column hydraulic casting-trimming press using large dies has been announced by the Hannifin Co., Des Plaines, Ill., a division of Parker-Hannifin Corporation. Although capable of high-speed operation up to 1300 ipm, the ram speed may be reduced to 240 ipm at the instant contact is made with the casting. Castings are then trimmed with a "squeeze" rather than a blow. This soft shearing action is said to give a cleaner, more accurate casting trim, reduce the danger of damage to dies, and minimize rejects.

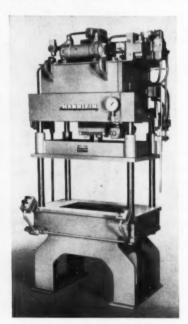
Compact design allows the new press to be placed near the casting machines. This eliminates transportation and stacking damage to warm castings. The press has a full ram stroke of 20 inches, a 30-inch gap, and a base 29 by 42 inches. The maximum drive is by a 20-hp motor and the hydraulic

pump capacity, 31 gpm.

Circle 578 on Readers' Service Card (This section continued on page 158)



Red Ring automatic loader for gear-tooth shaving or honing machines



Hannifin trimming press

When you think of FLEXIBILITY

Lucas provides

Lever control.

Tape control

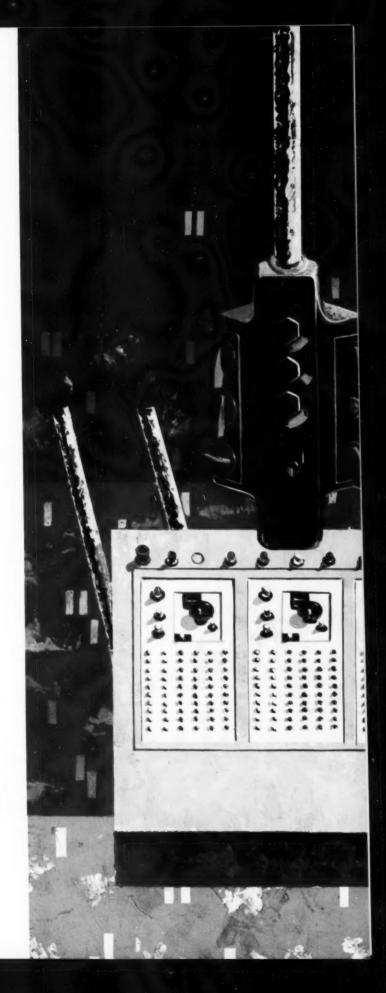
and a variety of combinations of the three for flexibility of control suited to the type of work required.

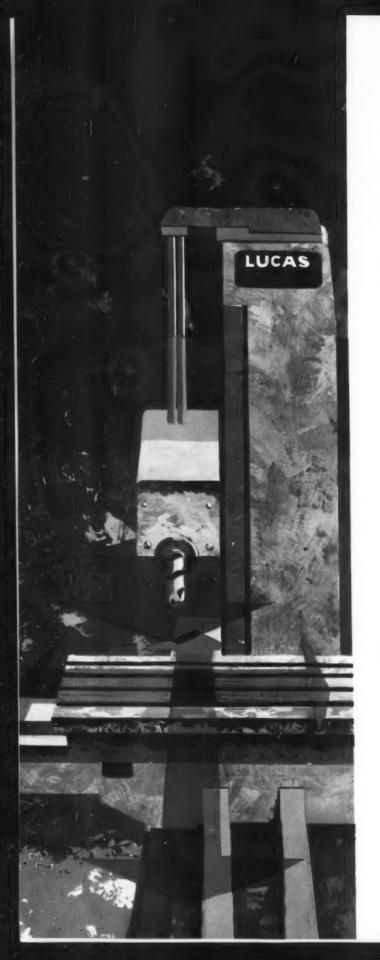
For example . . . The Multiple Control Pendant selects speeds, feeds, unit travels, rapid traverse of head, table, saddle and spindle, plus the rotation of the spindle forward and reverse, jog and stop. Speeds and feeds can be preselected while the machine is in operation.

Practical applications of these controls are spelled out in a new catalog. Write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of flexibility...

think of ...







When you think of VERSATILITY

Lucas feeds the saddle
Lucas feeds the spindle
Feeds both in combination
when necessary.

Combine these motions with

Vertical spindle head travel

and horizontal table travel \iff

if you need it.

The result...no machine tool can offer a greater combination of usable motions for boring, drilling, milling and related work.

Over twenty models and a dozen major attachments. Write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of versatility...

think of ...



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ALLOY DESIGNATION	WROUGHT	Composition — per cent (balance Fe)							
	TYPE (See Note A)	С	Mn max.	Si max.	P max.	S max.	Cr	Ni	Other Elements
CA-15	410	0.15 max.	1.00	1.50	0.04	0.04	11.5-14	1 max.	Mo 0.5 max.†
CA-40	420	0.20 - 0.40	1.00	1.50	0.04	0.04	11.5-14	1 max.	Mo 0.5 max.†
CB-30	431	0.30 max.	1.00	1.00	0.04	0.04	18-22	2 max.	_
CC-50	446	0.50 max.	1.00	1.00	0.04	0.04	26-30	4 max.	_
CD-4MCu	-	0.040 max.	1.00	1.00	0.04	0.04	25-27	4.75-6.00	Mo 1.75-2.25, Cu 2.75-3.25
CE-30	_	0.30 max.	1.50	2.00	0.04	0.04	26-30	8-11	_
CF-3	304L	0.03 max.	1.50	2.00	0.04	0.04	17-21	8-12	_
CF-8	304	0.08 max.	1.50	2.00	0.04	0.04	18-21	8-11	_
CF-20	302	0.20 max.	1.50	2.00	0.04	0.04	18-21	8-11	_
CF-3M	316L	0.03 max.	1.50	1.50	0.04	0.04	17-21	9-13	Mo 2.0-3.0
CF-8M	316	0.08 max.	1.50	1.50	0.04	0.04	18-21	9-12	Mo 2.0-3.0
CF-12M	316	0.12 max.	1.50	1.50	0.04	0.04	18-21	9-12	Mo 2.0-3.0
CF-8C	847	0.08 max.	1.50	2.00	0.04	0.04	18-21	9-12	Cb 8xC min., 1.0 max., or Cb-Ta 10xC min., 1.35 max
CF-16F	303	0.16 max.	1.50	2.00	0.17	0.04	18-21	9-12	Mo 1.5 max., Se 0.20-0.35
CG-8M	317	0.08 max.	1.50	1.50	0.04	0.04	18-21	9-13	Mo 3.0-4.0
CH-20	309	0.20 max.	1.50	2.00	0.04	0.04	22-26	12-15	_
CK-20	310	0.20 max.	1.50	2.00	0.04	0.04	23-27	19-22	_
CN-7M	-	0.07 max.	1.50	*	0.04	0.04	18-22	21-31	Mo-Cu*
HA	_	0.20 max.	0.35-0.65	1.00	0.04	0.04	8-10	_	Mo 0.90-1.20
HC	446	0.50 max.	1.00	2.00	0.04	0.04	26-30	4 max.	Mo 0.5 max.†
HD	327	0.50 max.	1.50	2.00	0.04	0.04	26-30	4-7	Mo 0.5 max.†
HE	_	0.20 - 0.50	2.00	2.00	0.04	0.04	26-30	8-11	Mo 0.5 max.†
HF	302B	0.20 - 0.40	2.00	2.00	0.04	0.04	19-23	9-12	Mo 0.5 max.+
нн	309	0.20 - 0.50	2.00	2.00	0.04	0.04	24-28	11-14	Mo 0.5 max. † N 0.2 max.
HI	-	0.20 - 0.50	2.00	2.00	0.04	0.04	26-30	14-18	Mo 0.5 max.†
HK	310	0.20 - 0.60	2.00	2.00	0.04	0.04	24-28	18-22	Mo 0.5 max.†
HL	_	0.20 - 0.60	2.00	2.00	0.04	0.04	28-32	18-22	Mo 0.5 max.†
HN	-	0.20 - 0.50	2.00	2.00	0.04	0.04	19-23	23-27	Mo 0.5 max.†
HT	330	0.35 - 0.75	2.00	2.50	0.04	0.04	13-17	33-37	Mo 0.5 max.+
HU	_	0.35 - 0.75	2.00	2.50	0.04	0.04	17-21	37-41	Mo 0.5 max.†
HW	-	0.35 - 0.75	2.00	2.50	0.04	0.04	10-14	58-62	Mo 0.5 max.†
HX	-	0.35 - 0.75	2.00	2.50	0.04	0.04	15-19	64-68	Mo 0.5 max.†

† Molybdenum not intentionally added.

* There are several proprietary alloy compositions falling within the stated chromium and nickel ranges, and containing varying amounts of silicon, molybdenum and copper.

Designations with the initial letter "C" indicate alloys generally used to resist corrosive attack at temperatures less than 1200° F. Designations with the initial letter "H" indicate alloys generally used under conditions where the metal temperature is in excess of 1200° F. The second letter represents the nominal chromium-nickel type; the nickel content increasing in amount from "A" to "X". For example, "F" stands for the 19%Cr-9%Ni, "K" for the 25%Cr-20% Ni, and "W" for the 12%Cr-60%Ni alloy types. Numerals following the letters indicate the maximum carbon content of the corrosion resistant alloys; carbon content may also be designated in the heat resistant grades by following the letters with a numeral to indicate the midpoint of a ±0.10% carbon range. If special elements are included in the composition they are indicated by the addition of a letter to the symbol. Thus, "CF-8M" is an alloy for corrosion resistant service, of the molybdenum-containing 19%Cr-9%Ni type with a maximum carbon content of 0.08%.

NOTE A.—Wrought alloy type numbers are listed only for the convenience of those who want to determine corresponding wrought and cast grades. Because the cast alloy chemical composition ranges are not the same as the wrought composition ranges, buyers should use cast alloy designations for proper identification of castings.

NOTE B—Most of the standard grades listed are covered for general applications by American Society for Testing Materials specifications A 296-59T and A 297-59T. ASTM specifications A 217-58T, A 351-58T, A 362-52T, B 190-50 and B 207-50 also apply to some of the grades.

Courtesy of Alloy Casting Institute, 1001 Franklin Ave., Garden City, N. Y.

NIKON model 6 OPTICAL COMPARATOR

new compact model offers greater screen brightness, accuracy and versatility than any other bench unit

Despite its relatively small proportions, the Nikon 6 offers performance features previously available only in the most elaborate units.

The magnification range of the Nikon 6, with its standard lenses, extends from 10X to 100X. The use of bayonet-mounted Nikon lenses provides greater speed and ease of interchangeability, and insures more accurate seating of the lenses than is possible with screw-threaded mounts. An accessory 3-lens revolving turret is available which also accepts bayonet-mounted Nikon lenses.

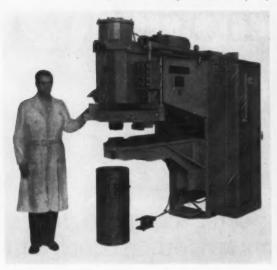
The Nikon 6 permits surface as well as contour inspections, either independently or simultaneously. It is equipped with a variable brightness control for adjusting the brilliance of the contour illumination, providing for utmost comfort, and freedom from eyestrain during continuous inspection procedures.

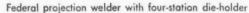
The Nikon 6 does not employ conventional oblique lighting for surface inspection. Half-reflecting mirrors, available for each lens, provide vertical, shadowless surface illumination on the optical axis. The elimination of shadow permits greater accuracy in making surface measurements. This is further aided by the extreme brightness of the image on the screen, resulting from the efficiency of the comparator's illumination system and the high speed of the lenses.

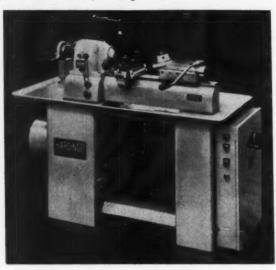
The basic Nikon 6 includes a standard 12-inch center-line screen with chart clips, and matched condensers for lenses of all magnifications. A wide variety of available stages, fixtures, and other accessories, fits it for virtually every application involving inspection and measurement of precision parts.

For descriptive, illustrated catalog, write to Dept. M-1.









Hardinge Superprecision second-operation machine

Federal Press Type Projection Welder

The Federal Machine & Welder Co., Warren, Ohio, has brought out a press type projection welder equipped with a special fourstation dial type upper die-holder. This unique arrangement and the valving, regulating, and piping equipment permit the selection of four different weld forces through a four-button push-button station. The four push buttons enable the operator to choose any one of the four stations by simply pressing its button. The four-station dial type upper head automatically moves the die selected to the weld station. Proper air pressure for this particular station and the heat setting on the control panel are automatically selected.

After the operator has selected the proper station together with its pressure, heat, and time setting, he manually positions the tank or part and initiates the machine operation by means of a two-position foot-switch. The first position on this foot-switch will bring the head down only, so that the position of the part can be checked before welding. The second position initiates the weld timer sequence.

The machine has a throat depth of 48 inches from the center line of the slide to the front face of the frame. The lower arm is made of fabricated steel with a cast-copper conductor. This arm is designed to accommodate several different diameters and lengths of tanks and still maintain maximum strength with minimum deflection. The 500-kva water-cooled welding transformer is arranged with sixteen steps of heat regulation and is capable of providing a maximum secondary short-circuit amperage of 100,000 amperes. An antifriction roller-bearing slide operated by a 12-inch diameter air cylinder develops a maximum weld force of approximately 9000 pounds at 80-psi air line pressure.

Circle 579 on Readers' Service Card

Second-Operation Machine

Hardinge Brothers, Inc., Elmira, N. Y., has announced a superprecision second-operation Model DSM59-R lathe designed to set standards for fine precision work on a production basis. This machine has a round-collet capacity through the spindle of 1 1/16 inches, step-chuck capacity of 6 inches, and will swing work 9 inches in diameter over the bed. Spindle speeds range up to 4000 rpm. The headstock spindle is mounted on superprecision preloaded ball bearings and takes a full range of standard tooling-5C Hardinge collets, step chucks, jaw chucks, and faceplates.

The headstock frame has a large base for rigid mounting on the heavy bed casting to assure sustained accuracy under the heaviest loads. Hardened and precision-ground steel bedways of dovetail shape securely anchor the headstock, double-tool cross-slide, and turret in exact alignment. The headstock is aligned to the dovetail bed section by master gages to assure interchangeability of a wide range of bed attachments. The double-tool cross-slide takes standard tooling accessories for forming, cutting off, facing, and taper turning.

The turret incorporates superprecision preloaded ball bearings in the turret head and a superprecision roller-bearing-mounted index-pin to assure exact repeating of indexing positions.

The machine comes complete with a self-contained driving unit mounted in a welded steel base. It has a fast accelerating drive that provides instant starting, stopping, and reversing.

The base contains a tool-storage compartment and an electric control panel. A welded-steel chip pan has a built-in sump and electric coolant pump. The base is arranged for easy and efficient operation from a sitting position.

Circle 580 on Readers' Service Card

Precision Drill Grinder for Small-Size Drills

The Leland-Gifford Co., Worcester, Mass., has developed and patented a precision drill grinder which is capable of producing and reproducing any desired point on any drill from No. 80 to 0.250 inch in diameter. Unique features of this ultraprecision machine, known as the Drill Point Master, include: independent adjustment of point angle, lip length, and relief angle; two variable-power microscope viewers and sealed-beam light to assist in precise setting; pointangle adjustment from 60 to 180 degrees; lip relief from 0 to 26 degrees; and point thinning controlled to a thousandth of an inch by micrometer adjustments of wheel-slide and point-thinning carrier. All settings can be logged for exact duplication at any time.

One collet chuck serves both sharpening and thinning positions without readjustment, and only a minimum number of collets are required to take a full range of drill sizes. The drill is located optically under magnification up to 15×, and the accuracy and shape of the new point is not affected by lip wear, eccentricity, or other existing conditions. The collet chuck is designed and mounted so that drills of any length can be ground without interference.

The Drill Point Master is built for stability, ruggedness, and wear resistance consistent with the high



Leland-Gifford precision drill grinder for small drills

precision of the work it produces. It features a sandwich wheel developed especially for clean, dry grinding and point thinning without burning.

Circle 581 on Readers' Service Card

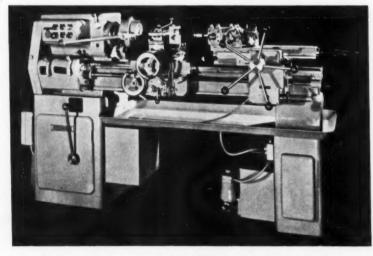
Sheldon Universal Ram Type Turret Lathe

A universal ram type turret lathe designed to meet the need for a low-cost, all-purpose production tool is being built by Sheldon Machine Co., Inc., Chicago, Ill. This versatile 3R turret lathe is equipped for turning between centers and single-point threading, as well as for performing standard turret operations. It has ample clearances to permit machining a

wide variety of work. Bar capacity is 1 1/2 inches, swing over bedways is 15 inches, and swing over cross-slide is 8 inches. These clearances permit the lathe to be used as a chucking machine, as well as for bar work.

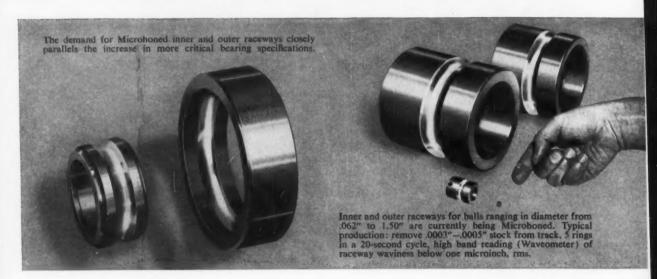
The ram turret has six working stations, is ruggedly built and accurately machined. The turret head is mounted on precision tapered roller bearings. All indexing parts are hardened and ground, and there are hardened wear strips and a tapered jib to assure long-life accuracy. The turret is equipped with a feed-box having power feeds which are engaged electrically by pressing push-button controls.

The travel range of the turret is 10 inches, and each turret face is bored to accommodate 1 1/2-inch standard shank tooling and to permit passing bar stock completely through the turret head. Each face is also drilled and tapped for standard flange type tools. A universal carriage provides both power longitudinal and power cross-feeds through apron clutches. This enables the lathe to be used for turning between cen-



Universal ram type turret lathe built by Sheldon Machine Co., Inc.

Now! Microhoning of raceways assures



THE most efficient means of minimizing friction between moving surfaces is a series of balls rolling in a raceway. However, any bearing can be no better than the quality of the raceway surface on which the balls roll. Because, imperfections in a raceway increase friction and noise, and shorten bearing life.

MICROHONING IMPROVES RACEWAYS

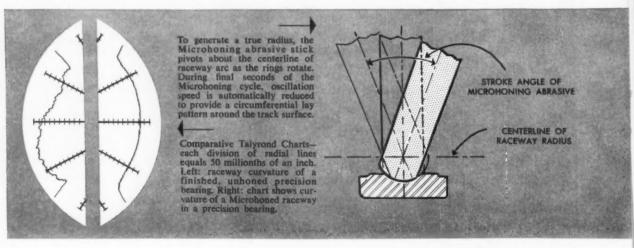
The ability of Microhoning to greatly improve the functional characteristics of raceway surfaces is strongly evidenced in the following: (1) improved concentricity between raceway and bearing bore; (2) removal of humps in raceway and truing of track plane; (3) correcting track curvature for greater contact with balls; (4) simultaneous improvement of accuracy and surface finish.

PROVED BETTER BEARING PERFORMANCE

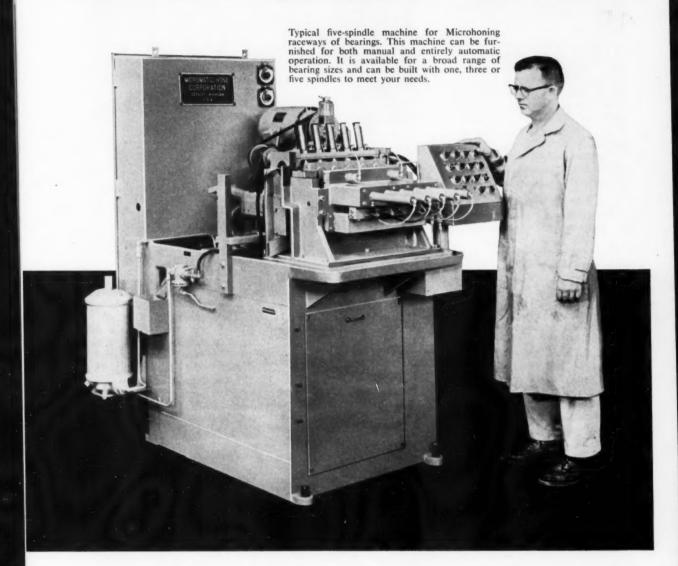
Many bearing manufacturers and users have conducted critical comparative performance studies of Microhoned bearings. They are convinced that Microhoning of inner and outer raceways, and other critical surfaces assures precision bearings that run smoother, quieter and longer than those processed by any other method.

FASTER PRODUCTION PROCESSING

Microhoning is the first successful method for automatic processing and handling of raceway rings on multiple-spindle machines. The number of spindles used (usually three or five) is dependent on bearing size and required production volume. Regardless of production factors, Microhoning increases production capacity several times over output of former methods.



quieter-running, longer-lasting bearings



The basic Microhoning principles (a combination of motions, low-velocity abrading, controlled pressure, float in tool) can also be applied to improve the functional characteristics of raceways for: cylindrical roller, tapered roller, needle, thrust and self-aligning bearings as well as other critical bearing surfaces.

For further information, write to:

Typical Application

Part: Inner Bearing Ring
Ball Track Radius: .1594"
Material: 52100 Steel, 60-62 R "C"
Stock Removal: .0003" - .0005"
Race Curvature (Tolerance): .000025"
Surface Finish (Tolerance): 1-2 microinches, rms
Production: 600 parts per hour



MICROMATIC HONE CORP.

ters up to its maximum center distance of 33 inches. The lathe is also equipped with a 60-pitch gear-box, precision lead-screw, and thread-chasing dial for single-point threading.

Sixteen spindle speeds from 22 to 1250 rpm are available through the 5-hp, two-speed geared motor. An optional higher range of 32 to 1800 rpm is also available. The lathe is completely equipped with all electrical equipment, front and rear tool-blocks for cross-slide, coolant pump and piping system, oil-collecting pan, and splash guards.

Circle 582 on Readers' Service Card

Fractional-Horsepower, Variable-Speed Drive

A fractional-horsepower, variable-speed drive said to be the most compact and lightest available to industry has been announced by Sterling Electric Motors, Los Angeles, Calif. This Speed-Trol has speed ranges from 4660 down to 1.2 rpm with up to 10-to-1 variation and is offered in 1/4-, 1/2-, and 3/4-hp ratings. Large pulley diameters are used to assure a cool-running, long-lasting belt.

Retention of important NEMA standard dimensions for shaft height and diameter permit sub-



Fig. 1. Control panel of Carlton Model 600 numerical-positioning control

stitution with standard motors. The line includes single-phase and three-phase types with dripproof, totally enclosed and explosion-proof style enclosures. The unit may be foot-mounted in any position or furnished with a face-mounting bracket.

Circle 583 on Readers' Service Card

Carlton Numerical-Positioning Control

A Model 600 numerical-positioning control for point-to-point positioning of machine elements has been introduced by the Carlton Controls Corporation, Worcester, Mass. This absolute decimal digital control employs no binary or analog circuitry and is an unusually simple, compact system. All major electrical and electronic elements are of the plug-in type.

The servo control is of the closed loop type, with the final positioning movement always made in the same direction to eliminate the effect of backlash in drive and control. Data input to position transducer is by means of either lead-screw or rack. Zero-adjust transducer clutch can be supplied as optional equipment.

Circle 584 on Readers' Service Card



Speed-Trol fractional-horsepower, variable-speed drive announced by Sterling Electric Motors

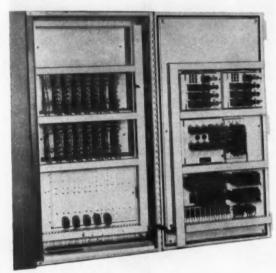
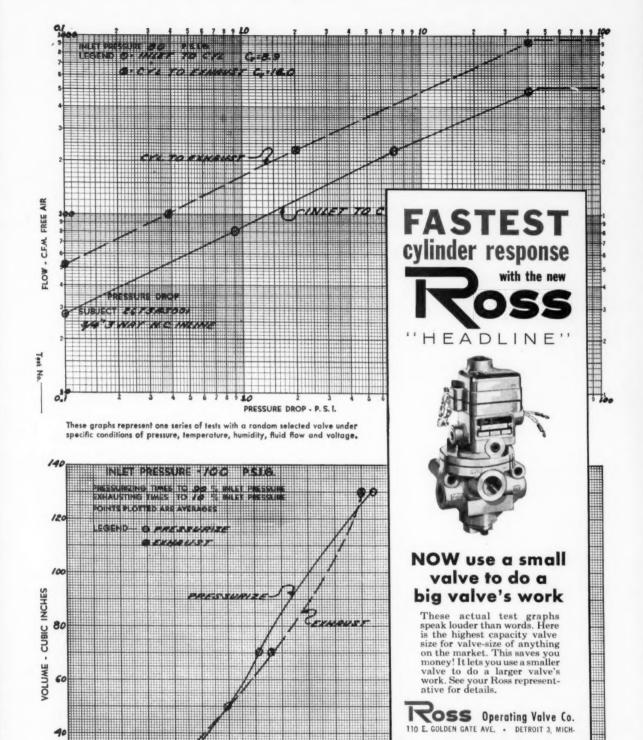


Fig. 2. Cabinet with plug-in type electrical and electronic elements of Carlton numerical control



Test No. 2008

RESPONSE TIME-SECONDS

RESPONSE TIME

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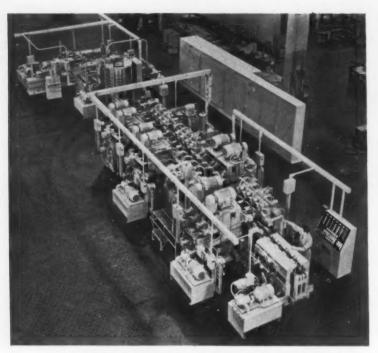


Fig. 1. Sectionized chucking Transfer-matic including new building blocks for turning operations built by The Cross Company

Cross Transfer-matic Includes Chucking in Automatic Processing of Wheel Hubs

The introduction of chucking type building-block units by The Cross Company, Detroit, Mich., makes it possible for parts requiring turning to be fully processed on this company's Transfermatics. The standardized chucking units for turning can be integrated with other building blocks in a transfer line to combine turning operations with drilling, milling, assembling, etc., on the same machine. It is claimed that performing all operations in this way on a single machine increases part uniformity, saves production time, and drastically reduces parts handling. Transfermatics of this type are sectionized so that operations which are similar or can be performed in about the same cycle time are grouped together.

Typical of the new family of sectionized chucking Transfermatics is a three-section machine, Fig. 1, designed for making wheel hubs, Fig. 3, for a European car. Rough malleable-iron castings are delivered to the transfer machine, which turns them into wheel hubs

ready for assembly. To balance the output of these hubs, turning, boring, and facing operations are performed on four work-pieces at a time in the first section of the machine. Drilling, broaching, and assembly operations are performed on one piece at a time in the second and third sections. The first and second sections are joined through an automatic, variable-speed work bank, and the first section is provided with extra capacity so that its output can be matched to the requirements of the other two sections. Parts are automatically conveyed from the second to the third sections without banking.

Work-pieces are placed manually, four at a time, in load-station nests. The transfer bar lifts the four pieces and moves them to the first machining station. Conventional three-jaw chucks, Fig. 2, of the new building blocks center, clamp, and rotate the parts. Turning and boring tools feed in and, simultaneously, facing tools are fed across the hubs. The four work-pieces are then transferred to the next station, where they are chucked from the other side. In the next two stations, hubs are held by diaphragm type chucks for greater accuracy, and semifinish and finish operations are performed from both sides. The parts then enter the bottom of the cylindrical work bank and are rolled to its top by a rotating

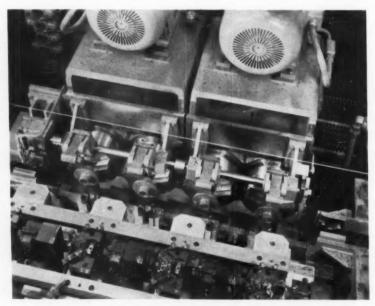


Fig. 2. Work-pieces centered and securely clamped in the three-jaw chucks of the machine shown in Fig. 1

drum. From the work bank the parts fall through a cushioned drop and roll, one at a time, to a stop in the load station of the second section.

The transfer bar of the second section deposits the hub in an orienting station that rotates it into the correct radial position. (From this point on, the part is transferred in the correct radial attitude but it is checked at each working station.) In the second section of the Transfer-matic, the four stud holes are drilled, spotfaced, countersunk, and reamed. By the end of this section, most of the machining operations on the parts, Fig. 3, have been completed. The hub is shown here substantially finished except for broaching of the stud holes and assembly of the studs.

Wheel hubs are turned on their sides as they enter the third section. The stud holes are broached to match the splines on the studs and then studs are automatically positioned in the holes, pressed

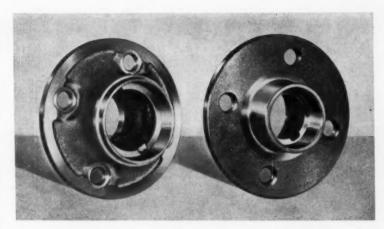


Fig. 3. Wheel hub as it looks on leaving the second section of the Cross Transfer-matic, Fig. 1

home, and staked. While the machine illustrated is used to process one specific part, the same equipment and methods can be used to machine almost any turned part. Milling was not required on this part, but building blocks for milling could be easily integrated with those for other operations.

Mich. At the same time, part-storage capacity is increased and parts are more readily available.

Unusual loading and unloading mechanisms make possible the reduction of center distances from 10 to 1 1/2 inches between partholding "pockets" in an overhead chain type conveyor. This provides an increase of 570 per cent in conveyor capacity. Thus, one distribution conveyor, such as shown in Fig. 1, is used to deliver 4200 parts per hour to satisfy demands at ten different points from a bank of

Gear-O-Mation Parts-Distribution System

Greatly increased volume of parts delivery, reduced conveyor speed, and selective distribution are all made possible by a system developed by Gear-O-Mation Division, Michigan Tool Co., Detroit,

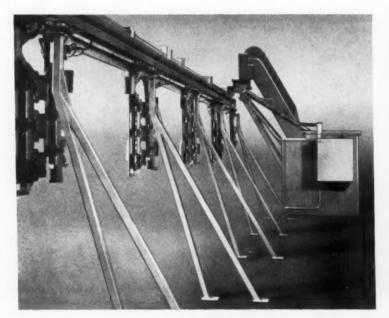
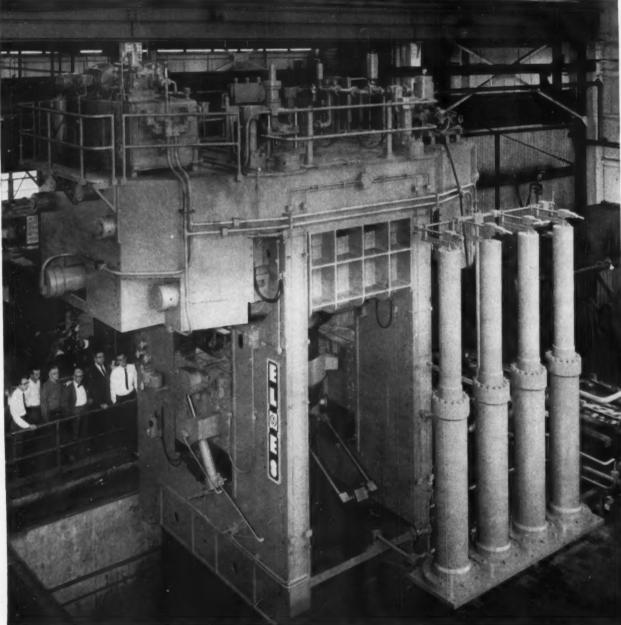




Fig. 1. (Left) Segment of Gear-O-Mation space-saving overhead distribution system for valve-body processing. Fig. 2. (Right) Close-up of conveyor, notched transfer wheel (arrow points to notch), and Velvet Drop of system shown in Fig. 1

ENGINEERED



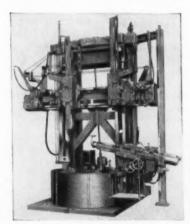
Job analyses provide an ever-widening scope in pressing applications. This huge hydrostatic press, weighing over 265 tons, was designed by Elmes hydraulic engineering specialists in cooperation with the Atomic Energy Commission. It was built by the Elmes/King Division for compacting various materials in a U.S. Government ordnance plant.

... for your job!

Profit-making performance may require high productivity, or wide versatility—or both. One sure requirement is lowest cost per piece!

This means that you must make a careful study of manufacturing equipment and methods—a close analysis of your individual job needs. Sometimes the answer is found through application of standard machines, either with or without modification. Sometimes specialized equipment is required. In any event, it pays to use the best of specialized experience —Elmes/King engineering experience!

To be sure that you get the most profitable installation for your particular boring mill operations or hydraulic press applications, get the recommendation of Elmes/King engineering service. Take advantage of 110 years of acknowledged leadership. Get service and machines that are "engineered . . . for your job"!



Specialized equipment is frequently the only answer for boring and turning operations on the large shapes used in missile work. This 72" King boring mill is specially equipped for a leading aircraft manufacturer. Job analysis by Elmes/King engineering results in profit-making performance.

Elmes/King Division offers COMPLETE LINES of standard boring mills and hydraulic presses. King® Vertical Boring and Turning Machines, manually controlled, and Electrol® full electrically controlled models, are built in sizes from 30" to 168" and up. Elmes® Hydraulic presses and equipment are built in a wide selection of types and sizes for metalworking and plastics applications in production, job shop, and laboratory. Consult your Elmes/King Distributor, or write direct.

ELMES/KING

Hydraulic Presses and Equipment / Vertical Boring and Turning Machines

American Steel Foundries, ELMES/KING Division 1162 Tennessee Avenue, Cincinnati 29, Ohio chucking machines. In this particular installation, designed for one of the "Big Three" auto makers, valve bodies are distributed equally to ten "Velvet Drops," feeding a bank of five chucking machines with two loading stations each. The Velvet Drop indicated by arrow in Fig. 2 is a patented, cushioned gravity feed that permits vertical feeding of parts without excessive acceleration. The part rolls rather than falls and reverses its rotation at regular intervals resulting in a gentle descent that protects it against nicks and scratches.

Valve bodies are elevated from the storage bin to the vibratory orienting table. From here the parts are loaded into all empty pockets in the conveyor. The pockets move continuously at the rate of 8 fpm, propelled by a chain type conveyor that also operates the notched unloading wheels.

At each machine drop, a valve body is transferred into a notched wheel. Each wheel has a single notch into which the body from every tenth pocket is transferred. That is, the first wheel's notch always receives from the first pocket in the ten-pocket chain increment; the second wheel's notch always receives from the second pocket, etc. Wheels rotate and bodies are released to machine loading chutes on demand. These chutes serve the machines as parts magazines. When the loading chute is full, the wheel transfers a valve body out of a pocket but retains it until the chute requires additional bodies. Meanwhile, the conveyor recirculates surplus parts.

Circle 585 on Readers' Service Card

Special Transfer Machine Performs Machining, Gaging, and Assembling Operations

A fifty-six-station, 114-foot long building-block transfer machine that drills, taps, spot-faces, mills, bores, and assembles a bushing and a stamped rectangular cup in aluminum automotive torque-converter case covers is announced by the Snyder Corporation, Detroit, Mich. This special machine utilizes advanced concepts of inprocess gaging, including hole probing and precision air gaging.

The random processing of two different parts that have many identical holes and surfaces to be machined, but are of different outside diameter and configuration, is accomplished by bolting an adapter on the smaller part. The adapter provides the smaller part with configuration and clamping surfaces that are similar to those of the larger part, thus enabling it to be transferred through the machine, without change-over of any clamping details or transfermechanism units. The adapter is provided with lug surfaces that automatically cause certain machining stations to be inactivated where necessary. Both large and small covers are processed on the machine at a rate of 150 pieces per hour at 100 per cent efficiency.

A center hole in the cover is precision-bored along with two other holes at the eleventh station. Then the cover is washed in Station 13. At Station 15, the center hole is air-gaged for both size and surface finish. A bushing is pressed in the center hole in the seventeenth station. The bushings

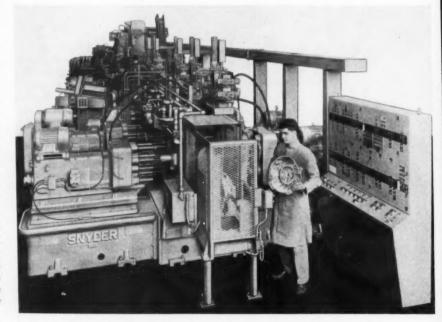
are brought into pressing position by a vibrating hopper feed.

A cup-shaped rectangular stamping that has been precoated with sealant is automatically pressed into the cover and staked in position at Station 52. A vibrating hopper feeds and orients the stampings for the pressing operation.

In all, forty-six holes are machined in the processing sequence. Probing operations are performed after drilling and tapping to locate any undrilled holes or broken taps to cause immediate machine shutdown before damage occurs. Both end-milling and spot-facing operations are performed to finish hole and work surfaces on the covers.

The machine is made up of nineteen separate and distinct machining segments. Each of these segments includes Snyder standard building-block bases or center sections, machining units, and heads. A standard walkingbeam type index mechanism moves the covers from one machining station to the next. All machining units are provided with hardened and ground ways and automatic lubrication systems.

Circle 586 on Readers' Service Card (This section continued on page 170)

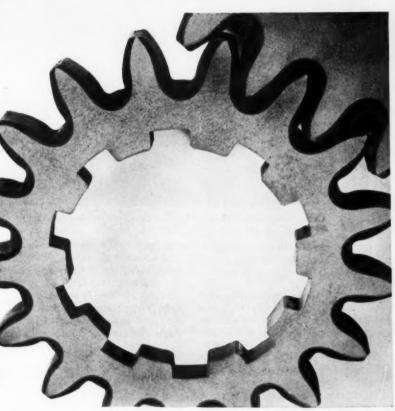


Snyder special transfer type machine that processes two different parts at random and performs machining, gaging, and assembly operations on aluminum cover cases

at Farrel-Birmingham

NEW SAF

TOOTHTO-TOOTH
INDUCTION
HARDENING



Typical hardening pattern along flanks and through root.

...produces toughest gears yet!

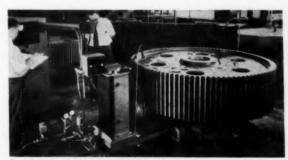
There's nothing like the S & F method of tooth-to-tooth gear hardening. Not only does it add amazing durability to big gears, but load-carrying capacity is vastly increased. Warpage can be insignificant depending on gear design. And there can be substantial savings in material and machining costs!

Farrel-Birmingham tells us that in one installation large gears with S & F induction-hardened teeth have already gone through over two years of rugged service with absolutely no sign of wear—whereas formerly, gears had to be replaced every two years. Reports of other installations are also highly satisfactory.

Precision controls maintain constantly accurate time, current, feed and distance between coil and workpiece to assure consistent results. In a group of similar gears, all portions of all teeth will have the same predetermined case contour and depth of hardness. In fact, hardening depth is so accurately controlled and warpage so minute that, for a number of gears, no additional machining is required.

S & F induction hardening units capable of handling gears from 3 in. to 20 ft. in diameter and larger, are available in semi-automatic and automatic models.

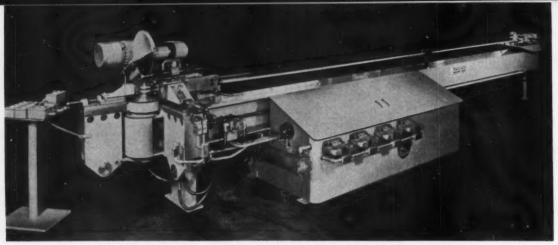
Want to know how this revolutionary approach to gear hardening can fit your production? Just ask us about it.



Spur, helical and double helical gears up to 157 in. diameter and 20 in. face widths are induction hardened tooth-by-tooth in this S & F equipment at Farrel-Birmingham, Ansonia, Conn.



42 Exchange Place, Jersey City 2, New Jersey



Combination tube-bending and cutoff machine announced by Wallace Supplies Mfg. Co.

Wallace Tube-Bending and Cutoff Machine

A machine which bends two 1 1/8-inch outside-diameter tubes to a center-line radius of 1 1/8 inches at one time and cuts off the bent pieces has been announced by the Wallace Supplies Mfg. Co., Chicago, Ill. After slipping 20-foot lengths of tubing over the mandrels of the machine, the operator presses a button which starts a completely automatic cycle that continues until both of the tubes have been used.

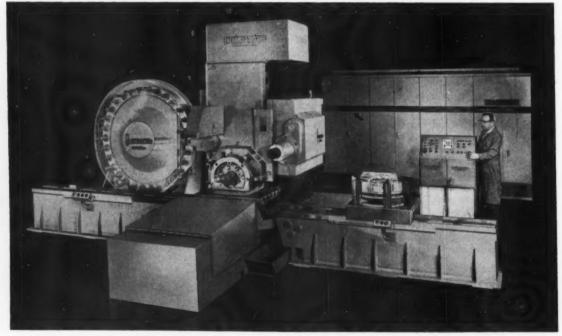
When the button is pressed, the tubes are advanced to stops. The

sliding pressure die then engages and advances the tubes. When the tubes have been securely clamped, the machine instantly starts the bending arm which rotates to the stop. The pressure die and mandrel are then withdrawn. This starts the sawing cycle which, when completed, causes the clamp to release so that the air exhausters can eject the tube. The arm then returns to the starting position which restarts the automatic cycle. This complete automatic cycle requires only four seconds.

Circle 587 on Readers' Service Card

Kearney & Trecker Milwaukee-Matic for Large Work

A larger, more powerful Milwaukee-Matic, designated the Model III, has been added to the line of numerically controlled manufacturing machines built by the Kearney & Trecker Corporation, Milwaukee, Wis. This new machine can be used to process work-pieces too large to be handled by the smaller Model II Milwaukee-Matic. The original Model II introduced a completely new



Model III Milwaukee-Matic announced by Kearney & Trecker Corporation

Pershing Machine Company

1435 N. BLACESTONE ST., JACKSON, MICHIGAN

Mr. John Prohaska Vice-President and Sales Manager The Cleveland Automatic Machine Co. 4932 Beech Street Cincinnati 12, Ohio

About six years ago, I bought my first Cleveland Single Spindle Automatic. I believe your company will be interested in what has happened to my screw machine shop since then.

I started my business in a small way, on a contract basis, with a little hand screw machine. In time, as more work came along, I found it necessary to install another screw machine. It was then I purchased my first Cleveland Single Spindle Automatic. I was more than happy with the fine performance of this machine. I was more than happy with the fine performance or this machine. As a matter of fact, I have stayed with Clevelands ever since.

As my business grew, I kept adding Clevelands, one after another.
All of us were more than satisfied with their smooth operation,
their dependability, and the precision work they turned out.
As a result, today in my shop I have ten single spindle Cleveland
as a result, today in my shop I have from the meet my special
automatics, some of which you rebuilt for me to meet my special
production requirements. Your service has always been outstanding.

All in all, I can truly say I must give full credit to Cleveland Automatics for the way my business started, grew up and prospered. You can be sure, whenever I need another automatic, it will be another dependable Cleveland.

Sincerely yours,

Pershing Machine Co.

"I give full credit to **CLEVELAND**

Automatics..."

"I must give full credit to Cleveland Automatics for the way my business started, grew and prospered", says Mr. Ray Saltzgaber, President of the Pershing Machine Company, Jackson, Mich. Shown below is one of 10 Cleveland Single Spindle Automatics in operation in this progressive screw machine products plant. Also pictured are four of a wide variety of parts which are produced from both ferrous and non-ferrous metals.

The precision, dependability and high performance of Cleveland Automatics can produce real profits



AUTOMATIC MACHINE COMPANY

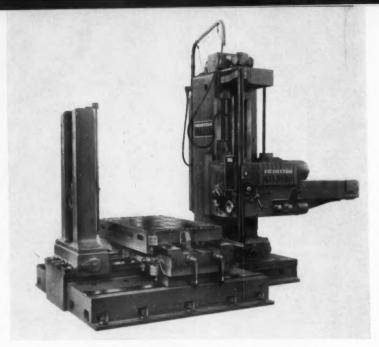
4936 Beech Street . Cincinnati 12, Ohio

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

Sales Offices: Chicago . Cleveland . Detroit . Hartford . Springfield, N. J.

metalworking concept—unifying milling, drilling, boring, reaming, tapping, and other related operations into a single tape-controlled manufacturing center. It was said to be the first machine to provide all of the many benefits of automation on small- and medium-lot parts requiring such a variety of machining operations. The new Model III machine now offers the same benefits together with the ability to handle larger work.

The automatic tool-changer magazine has a capacity of thirty tools plus one in the spindle and can make tool changes in fifteen seconds. Maximum tool-diameter capacity is 6 inches. Total spindle movement includes 44 inches on the longitudinal (X) axis, 34 inches on the vertical (Y) axis, and 32 inches on the depth (Z) axis. A 15-hp spindle drive motor provides power for three speed ranges of 50 to 2000 rpm in 10rpm increments. Feed rates range from 1/2 to 49 ipm in 1/2-inch increments. The rapid-traverse rate is 150 ipm. The rotary table automatically indexes 360 degrees



Cincinnati Gilbert boring mill designed for tape control

in 1-degree increments. Workpiece pallets are automatically transferred to and from the rotary table on the pallet shuttles.

Circle 588 on Readers' Service Card

Boring Mill Designed for Tape Control

A completely new table type, precision horizontal boring, drilling, and milling machine with a 4-inch spindle has been announced by the Cincinnati Gilbert Machine Tool Co., Cincinnati, Ohio. This machine is designed on the building-block principle and is offered in an almost unlimited combination of table, saddle, bed, and column sizes. It utilizes the latest developments in both numerical positioning and contouring controls, and is ideally suited for tracer controls.

In addition to tape controls, the machine may be supplied with the basic vernier measuring system, optical measuring, precision rod and dial-indicator measuring, or precision automatic positioning of the head, table, and saddle. The automatic positioning device, accurate to 0.0001 inch, may be used with precision rods or prebored job rods.

The machine is offered in a basic model with combination selective pendant and hand-shift control; and also in the Di-Matric model with complete pendant control. Feeds and speeds are each automatically shifted hydraulically by means of trouble-free rotary selector valves mounted on the head. The desired feed or speed is obtained by simply turning the control handle. The gears shift quickly and quietly. Optionally, the feeds and speeds may be preselected and automatically shifted from the pendant control. All feed and drive clutches are electromagnetic and are designed for smooth operation and easy control.

There are twenty-seven spindle speeds, twelve spindle feeds, and twenty-four feeds to the saddle, head, and table on the standard machine. As an option, twelve extremely fine feeds to the spindle may be furnished to obtain excellent finishes on stainless steels and the more exotic metals in use today. The main drive motor (up to 20 hp) is mounted on the head, and there are only three pairs of gears driving in the high-speed range. Rapid traverse to all units,

including the spindle, is standard equipment and is driven from a separate motor on the head. Lubrication of the head is from a separate motor interlocked to prevent the machine from operating unless the pump is functioning properly.

An adjustable depth dial, graduated to either 30- or 36-inch spindle travel, includes a kick-out for spindle feed. This arrangement covers the full spindle stroke without resetting. In addition, a fine-feed handwheel graduated to 0.001 inch is geared into the depth dial for precise boring to shoulders. All sliding way surfaces on the head are lined with nonmetallic inserts. The saddle and bedways are equipped with hardened and ground tool-steel replaceable ways.

Columns are offered with 36-, 48-, 60- and 72-inch vertical travel of the spindle head. Table widths are 38, 48, and 60 inches. Lengths range up to 132 inches. Beds are offered in a basic 36-inch width and also widths of 60, 84, and 120 inches. Saddle supports, installed with floor level, are offered with the basic 36-inch wide bed. Bed lengths are 54, 78, 92, 116, and 140 inches from faceplate to bar support.

Circle 589 on Readers' Service Card
(This section continued on page 174)



Did you know this about foreign competition?

Foreign manufacturers who are actively competing for markets in the U. S. and throughout the world have enjoyed some real cost advantages in the past. Today they are faced with labor shortages and rising labor costs which are whittling down their profits.

What are they doing to solve these problems? They are turning to the one proved answer that exists today—automated special machinery which CONTROLS production costs and gives them back their competitive edge.

The fact that these operations may be, relatively, smaller than their U. S. counterparts doesn't mean that they can't use automated special machinery successfully. On the contrary, such equipment (already proved practical in limited production in the U. S.) is the *only* solution to many of their cost problems.

As one of the early pioneers in special machinery for low-cost production, Snyder is especially well qualified to explore, with your engineers, the successful use of such equipment in your operation, here or in Europe. It costs nothing to do this and we'll be glad to talk with you.

SNYDER

CORPORATION

(Formerly Snyder Tool & Engineering Company)
3400 E. LAFAYETTE · DETROIT 7, MICHIGAN

Phone: LO 7-0123

PLANTS 1 and 2, DETROIT . PLANT 3, MANCELONA . PLANT 4, ELK RAPIDS, MICHIGAN

Wesson Tool-Cartridge System Standardized

Wesson Co., Ferndale, Mich., has standardized its cartridge designs in five basic styles which will take care of the vast majority of all applications for the system. In addition, it has made the cartridges available to other tool manufacturers and to tool users who wish to design and produce their own tool bodies. The system simplifies the use of combination tools to perform multiple operations. Further, the cartridges are salvageable and can be used in new tool designs when and if the original tools for which they were used are no longer needed.

Individual cartridges can be adjusted axially and radially. Throwaway carbide inserts of special and standard grades fit in the cartridges. Inventory needs are minimized, because only a few styles of cartridges, and even fewer insert styles, are used on any one tool. The cartridge styles available are: BS-100 for square inserts used when facing and through boring; BT-200 for triangular inserts used for boring or facing to a 90-degree shoulder, and for plunge facing; BT-300 for triangular inserts used when 45-degree chamfering. through boring, or boring to a 45-degree shoulder; BT-400 for triangular inserts used during 30-

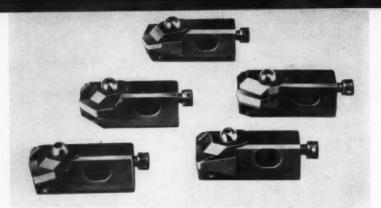


Fig. 1. The five basic styles of Wesson's standardized cartridge system

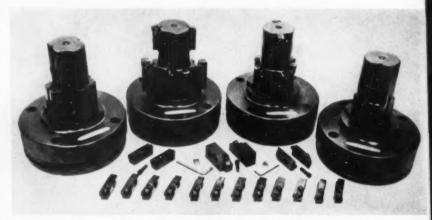
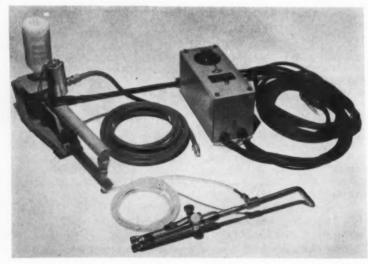


Fig. 2. Multiple tooling of cartridge-system elements

degree chamfering or out facing; and BP-500 for pentagonal inserts used for through boring. All but BP-500 cartridges are available in right or left hand of either positive or negative rake. The BP-500 is available with negative rake only in right- or left-hand styles.

Circle 590 on Readers' Service Card



Components of Air Reduction's new Aircospray equipment, which permits simultaneous spraying and fusing of powdered metals on a base metal by means of an oxyacetylene flame

Aircospray Metal-to-Metal Surfacing

A versatile and inexpensive metal-to-metal surfacing process, called Aircospray, has just been introduced by the Air Reduction Sales Co., a division of Air Reduction Co., Inc., New York City. This process is designed expressly for hard-surfacing and brazing operations. It permits powdered metals to be sprayed and fused simultaneously on a base metal by means of an oxyacetylene flame. Powdered metals of a high melting point can be deposited on a base metal of a lower melting point. The fact that alloys of greater hardness can be compounded in powdered form than in standard rod form is also used to advantage by the new process. It can be utilized on such parts as



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custom Gears and Gear Boxes assure this kind of dependability. They are precision made, guaranteed to meet your specifications exactly!

Ask for this brochure—CINCINNATI custom gears are made in all types to 72" diameter cut teeth, 39" shaved teeth, 25" ground teeth.

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THE CINCINNATI GEAR CO.

Cincinnati 27, Ohio Custom Gear Makers Since 1907 GEARS, good gears only pistons, valves, saw-blade guides, and any other sliding surfaces on engines, pumps, and farm machinery. Aircospray is said to work ideally whether depositing bands of surfacing on thin and light members or on heavier sections.

When used with phosphorus or silver filler metals, this process gives true capillary brazing (deep penetration), and permits placement of the filler metal, combined with flux, directly on the joint area. Thus, it is especially useful in the fabrication of metal office furniture and sanitary joints for hospital furniture. It can also be used for metal spraying solely, and spraying subsequent to fusing.

The basic element of the new process is a standard oxyacetylene welding outfit with a modified torch tip which permits the powdered metals to be sprayed through the oxyacetylene flame. Additionally, there is a carrier gas source, a means of dispensing and carrying the powdered metals to the torch tip and the necessary controls. The carrier gas may be argon, helium, nitrogen, or carbon dioxide. The fuel gas can be either acetylene or natural gas.

The fineness and uniform emission of the powdered metals available with Aircospray make it possible to have depositions down to 0.003 inch in thickness. This means an added labor-saving fac-

tor if grinding is needed to bring the product down to the desired size. To further extend versatility. Aircospray offers torch tips in three styles and a total of fifteen models.

A silver-brazing filler metal with a flux core for faster and easier brazing has also just been placed on the market by the Air Reduction Sales Co. This new product, designated Aircosil Fluxcor 45, assures the correct amount of flux for the size of the brazing alloy used.

Circle 591 on Readers' Service Card

Hydraulic Machine for Finishing Valve Guides

A vertical valve-seating and gun-boring machine built by the Foote-Burt Co., Cleveland, Ohio, employs a swiveling fixture to perform a twelve-spindle operation with only six spindles. The machine finishes intake and exhaust valve guides for a six-cylinder engine head in an Australian plant. The cast-iron head clamps on a manually indexed fixture which swivels 180 degrees after finishing the first six holes. This locates the part for finishing the second six holes.

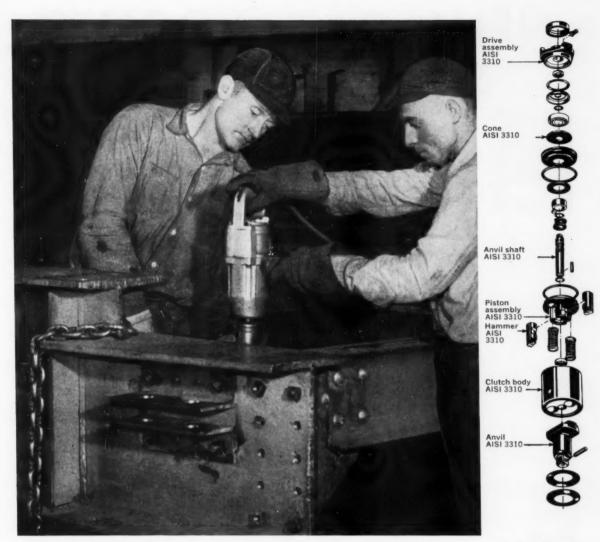
Each of two 3-hp motors on the head drives three quill type double spindles. In operation, a cutter on each quill spindle forms the valve seat and chamfers a 130degree clearance angle. Then it retracts slightly, and acts as a guide bushing for the center gunbore spindle and a tool which machines the valve-guide hole. Coolant at 25 psi is forced through the tool shanks to the cutting edge. The coolant and chips collect in the machine base-a feature of nearly all Foote-Burt machinesand is pumped through a separate filter to remove all swarf over 5 microns in size. A Micro-Fog system assures proper spindle lubrication at all times.

Both rapid traverse and feed of the head are hydraulically powered. Feed for the quills and the gun-boring spindles is also hydraulic. By drilling six holes at once, this unit achieves the precision of a twelve-spindle machine without the complexity and original investment. Round ways are employed for self-cleaning, high accuracy, and long life.

Circle 592 on Readers' Service Card (This section continued on page 192)



Footburt hydraulic vertical valve-seating and gun-boring machine



Strong, tough Nickel alloy steel parts stand up to severe shock as Gardner-

Denver impact wrench brings nut-andbolt assembly up tight as a weld.

Hard-hitting impact wrench lasts longer, thanks to 31/2% Nickel alloy steel parts

Each time the socket slams against the faces of a big square or hex nut, seven vital parts of this Gardner-Denver impact wrench sustain the same sharp, powerful blow they deliver.

For built-in resistance to this repeated wear, shock-loading and torsional stress, engineers at Gardner-Denver specify AISI 3310 alloy steel (31/2% Nickel) for all seven components that bear the full brunt of this battering:

- · Drive assembly
- · Hammer
- · Cone
- · Clutch body
- · Anvil shaft
- · Anvil
- · Piston assembly

All these parts, made from carburized and hardened 31/2% Nickel alloy steel, develop a hard, wear-resistant case backed up by a strong, tough core for resistance to countless shocks.

Typical core properties developed by heat-treated AISI 3310 steel:

Tensile strength	170,000 psi
Yield point, min.	140,000 psi
Elongation	15% in 2"
Reduction in area	60%
Brinell hardness	

Exploded view of Gardner - Denver Model 18B-9 impact wrench reveals vital parts made from AISI 3310 Nickel steel for impact resistance.

When you design, order, or use heavily stressed machine components, remember that Nickel alloy steels take the tough jobs in stride. For engineering data to help you select the best materials for specific applications, just write. We'll be glad to help.

THE INTERNATIONAL NICKEL COMPANY, INC.



67 Wall Street INCO New York 5, N. Y.

NEW CATALOGUES

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Machining Heads

Master Mfg. Co., Inc., Hutchinson, Kan. Catalogue 160 containing information on Master machining heads for milling, boring, and drilling operations. Dimensional data and specifications are included, along with other products of the company.

Circle Item 501 on Inquiry Card



Code Converter

Friden, Inc., Rochester, N. Y. Booklet on the Friden code converter, a tape-operated communications machine. It converts any five-, six-, seven-, or eight-channel system-one to the other-when two different tape code systems are used.

Circle Item 507 on Inquiry Card



Modular Benches and Bins

Bay Products, Inc., Philadelphia, Pa. Catalogue covering a line of benches, bins, cabinets, shelving, stock carts, and accessories. Features of the modular benches include a choice of widths and interchangeability with nonpede-

Circle Item 502 on Inquiry Card



Induction Motors

Lincoln Electric Co., Cleveland, Ohio. Bulletin No. 6100.1 describing design and size range of Lincoln's redesigned line of squirrel-cage induction motors. Features include Multiguard stator encapsulation and open protected construction.

Circle Item 508 on Inquiry Card



Production Machine Tools

Rehnberg-Jacobson Mfg. Co., Rockford, Ill. Brochure on production machine tools and self-contained units. Included are cam-operated drill units, lead-screw tap units, a self-contained hydraulic quill unit, and automatic indexing tables.

Circle Item 503 on Inquiry Card



Sub-Zeroing

Cincinnati Sub-Zero Products, Cincinnati, Ohio. Technical article (reprinted from Modern Machine Shop) on sub-zeroing and its benefits to gear and pinion production. Included are carburizing and heat-treat procedures and assembly methods.

Circle Item 509 on Inquiry Card



South Bend Lathe, Inc., South Bend, Ind. Folder providing information on the company's precision lathes. Included are descriptions of a 16-inch toolroom lathe with 8-foot bed and a 16-inch engine lathe with 6-foot bed. Specifications are given.

Circle Item 504 on Inquiry Card



Optical Comparators

Jones & Lamson Machine Co., Springfield, Vt. Brochure presenting the company's Model FC-30ER optical comparator and measuring machine. Details on the lens selector, table-angle adjustment, and lateral and vertical measurements are given.

Circle Item 510 on Inquiry Card



Press Brakes

Dreis & Krump Mfg. Co., Chicago, Ill. Bulletin No. SS-60 giving data on the company's Chicago straight-side type press brakes with large die area. Included are the principal construction features as well as general specifications

Circle Item 505 on Inquiry Card



Tubing

Jones & Laughlin Steel Corporation, Electricweld Tube Division, Pittsburgh, Pa. Brochure providing weight computations for welded steel tubing. Round mechanical tubing up to 10 inches square and rectangular tubing up to 5 inches are included.

Circle Item 511 on Inquiry Card



Shape-Cutting Machine

Linde Company, division of Union Carbide Corporation, New York City. Booklet (Form 55-040) presenting information on the Oxweld CM-56 automated flame-cutting machine, which can automatically reproduce metal parts from exact size drawings.

Circle Item 506 on Inquiry Card



Steel Pipe

Youngstown Sheet & Tube Co., Youngstown, Ohio. Brochure containing data on the features of Yoloy steel pipe, a copper-nickel high-strength. low-alloy steel available in continuousweld and seamless standard and extrastrong pipe sizes.

Circle Item 512 on Inquiry Card





RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY



Technical-ities

By Fred E. Graves

Fastening of gasketed joints

The right fastener for a "flexible" joint rests on type of gasket material and its compressibility. Total preload on all the fasteners in the connection must be enough only to compress the gasket and provide sufficient additional clamping force to withstand the hydrostatic test pressure. More than this brings on a good chance of leakage, through "bowing" of the clamping plate.



Exaggerated sketch showing how too much torque tends to distort clamping plate and leads to leakage.

HYPOTHETICAL CASE

Suppose a joint is tightened with Grade 5 Hex Screws to their yield strength, and leakage develops. By going to alloy screws and tightening still further you would still get leakage. But Grade 2 Hex Screws, all torqued evenly, would no doubt solve it.

ACTUAL CASE

The fasteners on one product's flange had to withstand a 4000 pound hydrostatic pressure. But the hard asbestos gasket used took a bolt load of 28,000 pounds for sufficient compression to seal. By substituting a rubber and fibre gasket in this case, bolt load could be reduced. So could bolt size, thereby saving 73% on fasteners.

Using Hex Screws in tapped holes saves money



In the cast "coupon" shown above, the hex screws were torqued tight and removed 50 times—then torqued to failure. Note in the cutaway that the casting's threads are still perfect with no sign of stripping. It was the screws which broke—a clear demonstration that castings fastened with hex screws will suffer no thread damage during repeated disassemblies.

TWOFOLD BENEFIT

When there are no space clearance problems or other special requirements, using studs of 1-inch diameter or smaller often penalizes the user. First, in direct costs, since the more economical hex head screws will do the job to specification. And second, in production costs, since studs require that tapped holes have an *interference* thread fit, which in turn results in slow, "selective" assembly to determine properly

mated threads. Hex screws need only a clearance fit, assemble faster.

ACTUAL EXAMPLE

In one of his surveys of fastenings used by one company, the RB&W engineer pointed out that over 250 stud fastenings were being used in a large refrigeration unit. The same number of hex screws, costing \$8.45, saved \$22 over the studs and nuts. Annually, the total would be \$7,800 on the production run of this unit.

Not to be overlooked either was the tangible saving on the less critical tapping job required.

RB&W offers its help on your specific fastener problems, or an overall survey of your fastener usage. Contact Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N. Y.

Plants at: Port Chester, N.Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales effices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

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Nitriding Processes

Armour Industrial Chemical Co., Chicago, Ill. Bulletin TM-1 covering the casehardening of metals with anhydrous ammonia atmospheres in various nitriding applications. Included is information on nitriding equipment and techniques.

Circle Item 513 on Inquiry Card



Recorders and Indicators

Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. Catalogue C15-1a highlighting design features of the two- to twenty-four-point ElectroniK universal recorder, and other ElectroniK strip- and circular-chart recorders and precision indicators.

Circle Item 519 on Inquiry Card



Variable-Speed Drives

Graham Transmissions Inc., Menomonee Falls, Wis. Bulletin 551 showing where and how to use an infinite-range, variable-speed drive of high accuracy. Principles of operation, special controls, and complete ratings and dimensions are included.

Circle Item 514 on Inquiry Card



Hi-Lo Temperature Chambers

Cincinnati Sub-Zero Products, Cincinnati, Ohio. Folder describing 1- to 10-cubic-foot Hi-Lo temperature chambers especially designed for lab and job-shop applications where temperatures from -150 to +300 degrees F. are required.

Circle Item 520 on Inquiry Card



Press Control

Rehrig Safety Controls, Los Angeles, Calif. Brochure presenting the company's Cycle-Chek all-electric press control. Designed for punch-press operations, it can be adapted to various automated operations and progressive automated sequences.

Circle Item 515 on Inquiry Card



Fasteners

Chase Brass & Copper Co. (a subsidiary of Kennecott Copper Corporation), Waterbury, Conn. Catalogue listing a line of bolts and nuts, cap and machine screws, washers, etc., which are available in Silnic bronze and other commonly used alloys.

Circle Item 521 on Inquiry Card



Automation System

Specialties, Inc., Syosset (L. I.), N. Y. Bulletin MT-2 covering the company's Specialmatic, a complete package automation system. It can be adapted to automate turret lathes, boring machines, grinders, welders, and drilling and milling machines.

Circle Item 516 on Inquiry Card



Abrasive-Wheel Dressing

Sidley Diamond Tool Co., Detroit, Mich. Bulletin describing a concept of dressing abrasive wheels. Illustrated is an electronically controlled power-driven circular dressing wheel known as the Crush-cutter traverse dressing tool.

Circle Item 522 on Inquiry Card



Motor-Generators

General Electric Co., Schenectady, N. Y. Bulletin GET-3064 describing G-E's machine tool motor-generators for feed-drive power-supply systems. Charts of operating characteristics and typical connection dimension diagrams are included.

Circle Item 517 on Inquiry Card



Alloy Steel Castings

Alloy Steel & Metals Co., Los Angeles, Calif. Bulletin No. 300 featuring the properties of "T-1" alloy steel castings, which are claimed to have excellent surface finish and can be cast in thin sections. Welding and machining data are covered.

Circle Item 523 on Inquiry Card



Drill Pointer

Winslow Product Engineering Corporation, Arcadia, Calif. Bulletin on the Model 100 Winslo-Matic drill pointer. Features include fully automatic cycle, automatic wheel dressing, pace-setter selector, infeed selector, and drill-point locator.

Circle Item 518 on Inquiry Card



Milling Machines

Kearney & Trecker Corporation, Milwaukee, Wis. Bulletin S-60 detailing the features of the company's S-12 knee type milling machines. A description of the column, knee, saddle, table, speed drive, feed drive, controls, etc., is given.

Circle Item 524 on Inquiry Card

Why the Die Maker Prefers PRODUCTO

Die Sets



Volkert Stampings, Inc.

The die maker likes to work with Producto Die Sets

He knows Producto die sets are easy to assemble -especially those equipped with the unique new Owik-Fit Guide Pins*.

He has confidence in the consistent accuracy of Producto sets. He has found that they always align his dies correctly.

He knows he can choose from a variety of thicknesses the Producto die set that meets the strength requirements of his die.

He favors Producto die sets because they are dependable. They will perform on the press as well as they did in tryout.

He likes the attractive, streamlined appearance of Producto sets. They make his dies look better and increase his pride in these products of his craftsmanship.

Patent Pending

He knows that a nearby Producto warehouse can supply any catalog die set he needs...and that orders for specials are promptly processed. He can count on having the die set by the time he needs it.

The die maker has found that all of his requirements are met by Producto die sets. You will, too, when you place your order with Producto.

DIE SET DIGEST, our eightpage quarterly, contains valuable data for designers, makers and users of dies. Write to have your name added to mailing list.



THE PRODUCTO MACHINE COMPANY 984 Housatonic Ave., Bridgeport 1, Connecticut



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Radial Drill

Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. Catalogue No. R-9 presenting information on a Bickford 9-inch radial drill designed to speed production and increase accuracy on a wide range of drilling, boring, and tapping operations.

Circle Item 525 on Inquiry Card



Microstoning Machines

Taft-Peirce Mfg. Co., Woonsocket, R. I. Catalogue 319 giving a description of Taft-Peirce/Supfina microstoning machines and attachments. Included are the Model 86 plunge-cut and Model 88 through-feed centerless microstoning machines.

Circle Item 531 on Inquiry Card



Lathe

Sidney Machine Tool Co., Sidney, Ohio. Bulletin covering the firm's new Model 4025 extra-heavy-duty engine lathe, with 75 hp, thirty-six spindle speeds, and simplified controls. Featured are complete product information and specifications.

Circle Item 526 on Inquiry Card



High-Temperature Alloys

Haynes Stellite Co., division of Union Carbide Corporation, New York City. Booklet describing Haynes complete line of high-temperature alloys as compared against each other in the areas of physical, mechanical, and chemical properties, etc.

Circle Item 532 on Inquiry Card



Chemical Tubing Analyses

Babcock & Wilcox Co., Tubular Products Division, Beaver Falls, Pa. Bulletin T-456 showing chemical analyses of the standard carbon, alloy, and stainless tubing steels used in corrosion-resistant, elevated-temperature, and/or pressure service.

Circle Item 527 on Inquiry Card



Forging Machine

Hermes Corporation, Pomona, Calif. Brochure containing a description of the Hermes Model K high-energy-rate production forging machine. Among its features are simple operation, rapid cycle, automatic part ejection, and rapid die opening.

Circle Item 533 on Inquiry Card



Broaching Machines

Sundstrand Machine Tool, division of Sundstrand Corporation, Belvidere, Ill. Bulletin covering Sundstrand-American four-way convertible broaching machines. Features include a capacity of 5 to 50 tons, with 30- to 90-inch strokes. Accessories are described.

Circle Item 528 on Inquiry Card



Gear Shaper

Fellows Gear Shaper Co., Springfield, Vt. Brochure presenting the Fellows 3-inch, fine-pitch gear shaper, available in three models. Cutterspindle driving mechanism, depth-feed mechanism, and feed-cam trip mechanism are covered.

Circle Item 534 on Inquiry Card



High-Vacuum Equipment

Hughes Aircraft Co., Oceanside, Calif. Short-form catalogue providing information on the company's high-vacuum equipment line. Included are descriptions of thermocouple gages, cold-cathode discharge gages, ionization gages, and ion pumps.

Circle Item 529 on Inquiry Card



Surface Grinder

King Machine & Mfg. Co., Los Angeles, Calif. Brochure covering the company's Model K-1020 hand-feed precision surface grinder. Design features include close-grain castings, sealed ball-bearing spindle, balanced motor, and rigid construction.

Circle Item 535 on Inquiry Card



Chemical Milling Compounds

Chem-Mill, a division of Turco Products, Inc., Wilmington, Calif. Catalogue on the company's chemical milling compounds—cleaners, deoxidizers, scale conditioners, descalers, maskants, etchants, acid pickles, and smut and mask removers.

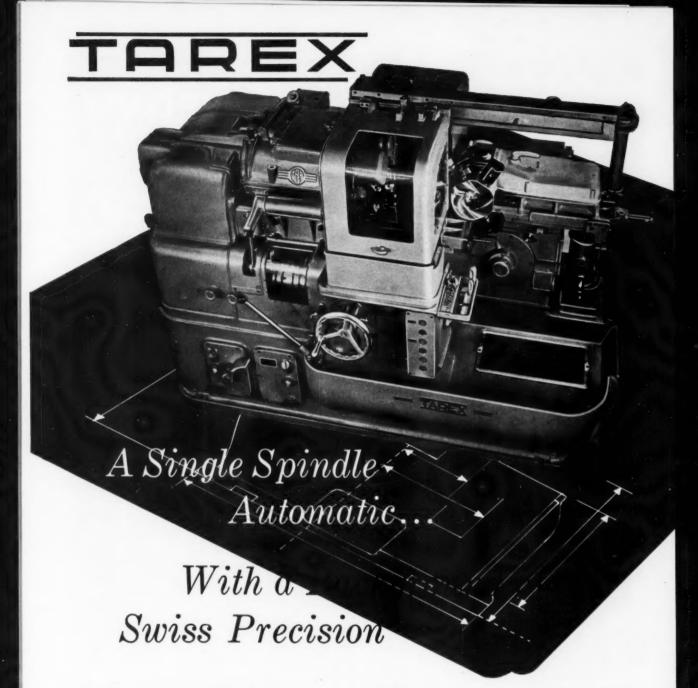
Circle Item 530 on Inquiry Card



Gear Shapers

Michigan Tool Co., Detroit, Mich. Bulletin No. 3000-60 on Series 3000 Shear-Speed shapers for rapid cutting of gears and other external forms. Methods of obtaining faster chip disposal and providing through-feed automation are illustrated.

Circle Item 536 on Inquiry Card



Only single spindle turret lathe with-

Universal spindle for both chuck and bar work without ever changing spindle*

Direct drive by gears-no chains

Set-up time reduced up to 60%

Tremendous versatility—exclusive, ingenuously designed standard and extra-capacity attachments.

*Only automatic that can machine hot rolled as well as cold drawn bars without changing spindle.

TAREX can solve all your chuck and bar work from dia. $\frac{3}{4}$ " to $\frac{31}{2}$ " of bar and 8" of chuck work.

Engineered for U.S. Production; Built and Serviced with Swiss Precision.

Submit your machining problem with blueprints for analysis and our recommendations.



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Surface Grinder

Landis Tool Co., Waynesboro, Pa. Catalogue 1 1/2-60 describing and illustrating the improved Landis abrasive No. 1 1/2 precision surface grinder. The machine accommodates a 10- by 15-inch chuck with a full 150 square inches of surface area.

Circle Item 537 on Inquiry Card



Optical Flats and Micrometers

Van Keuren Co., Watertown, Mass. Buyers catalogue and price list (36B, Section "O") presenting the company's optical flats, monochromatic lights, and light-wave micrometers. Included are laps and surface plates, and lapping and testing equipment.

Circle Item 543 on Inquiry Card



"Spectrum of Capabilities"

Servo Corporation of America, Hicksville (L. I.), N. Y. Brochure describing the company's research, development, and production capabilities. Detailed are such Servo specialties as infrared, optics, electronics, data handling, servo devices, etc.

Circle Item 538 on Inquiry Card



Adhesives and Coatings

Minnesota Mining & Mfg. Co., St. Paul, Minn. Catalogue (A-ZBD-102-JR) containing fold-out tables listing the uses, characteristics, and general properties of over 170 different adhesives, coatings, and sealers. Applications are included.

Circle Item 544 on Inquiry Card



Precious Metals

Engelhard Industries, Inc., Newark, N. J. Booklet describing Engelhard Industries, Inc., its products, and the objectives of its extensive research, which is principally in the industrial use of platinum and other precious metals.

Circle Item 539 on Inquiry Card



Grinder

Landis Tool Co., Waynesboro, Pa. Bulletin CX-60 featuring information on the Landis 4-inch concentric grinder. With this machine, outside diameters of bearing races or rings for precision mechanisms can be ground within close limits.

Circle Item 545 on Inquiry Card



Turret Drill

Cincinnati Lathe & Tool Co., Cincinnati, Ohio. Brochure covering the Cintimatic turret drill, a six-turret numerically controlled machine designed to afford quick and simple setup with minimal jig and fixture requirements. Specifications are given.

Circle Item 540 on Inquiry Card



Arc-Welded Design

James F. Lincoln Arc Welding Foundation, Cleveland, Ohio. Booklet containing data on the foundation's \$25,000 award program for progress in arc-welded design. Time and patent restrictions, treatment of subject matter, etc., are included.

Circle Item 546 on Inquiry Card



Spring Fasteners

George K. Garrett Co., Inc., Philadelphia, Pa. Catalogue illustrating standard and special spring fasteners in twin-prong or cone type impressions and push-on types. Information concerning tensile, torque, and other design requirements is provided.

Circle Item 541 on Inquiry Card



Welders

Sciaky Bros., Inc., Chicago, Ill. Bulletin 320-8 completely describing and illustrating the Sciaky Type MPT-2 airoperated, press type, three-phase seam welder designed to cover a wide range of commercial and military welding applications.

Circle Item 547 on Inquiry Card



Tooling Balls

Industrial Tectonics, Inc., Ann Arbor, Mich. Bulletin describing applications of hardened stainless-steel tooling balls. These products consist of a precision ball and shank, and are used in making and checking jigs, fixtures, and machine setups.

Circle Item 542 on Inquiry Card



Socket Screws

Holo-Krome Screw Corporation, Hartford, Conn. Bulletin on socket screws machined by the company's Thermo-Forged process, which preheats and preconditions the metal by an electronic method. This results in continuously controlled ductility.

Circle Item 548 on Inquiry Card

IT'S LIGHTER THAN YOU THINK!

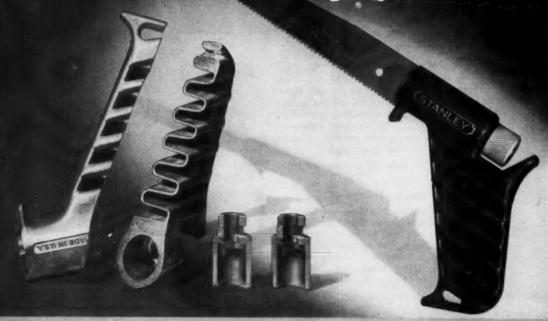
ONE-PIECE CONSTRUCTION with MAN-SIZE GRIP and a MINIMUM OF METAL

The handle of this new keyhole saw, by Stanley Works, is designed for "heft" with a full, man-size grip, exceptional strength and rigidity, yet it has light-weight, metal-saving construction.

Detail of this unique, improved design is shown in the sectioned sample of the handle and both halves of the blade chuck. A minimum of secondary operations simplifies production and helps cut manufacturing costs.

...IT'S DIE CAST WITH





HORSE HEAD® SPECIAL ZINC AND HORSE HEAD ZAMAK ARE PRODUCED BY

THE NEW JERSEY ZINC COMPANY

DEVELOPERS OF THE ONLY STANDARD ZINC DIE CASTING ALLOYS IN USE TODAY

160 Front Street • New York 38, N. Y.



• Yours for the asking . . . use postcard inside back cover



Torque Actuators

Ex-Cell-O Corporation, Greenville, Ohio. Bulletin 266013 describing midget Rotac torque actuators, which employ hydraulic or pneumatic pressure to produce rotary reciprocating movements. They are used for light applications in instruments, computers, etc.

Circle Item 549 on Inquiry Card



Machine Mount

Air-Loc Division, Clark-Cutler-McDermott Co., Franklin, Mass. Catalogue presenting the company's Bolt-Thru Wedgmount for bolting machinery to the floor, which assures positive dampening and control of vibration, shock, and noise.

Circle Item 555 on Inquiry Card



Sintering

Electric Furnace Co., Salem, Ohio. Bulletin No. 603 describing the advantages, physical properties, and applications of powdered-metal parts. The different types of furnaces that are being used to heat-treat the compacts are illustrated.

Circle Item 550 on Inquiry Card



Chucking Machines

Baird Machine Co., Stratford, Conn. Catalogue No. 10 presenting Baird's high-speed automatic Model 76-H six-spindle and Model 78-H eight-spindle chucking machines. Listed are complete specifications and the availability of optional attachments.

Circle Item 556 on Inquiry Card



Expanding Arbor

Hughes Engineering Co., Costa Mesa, Calif. Data sheet providing details on Heco "On-The-Ball" expanding arbors, for use in any machine or fixture equipped with a standard 5C spindle nose and operated by a leveraction collet closer.

Circle Item 551 on Inquiry Card



Boring Machines

Bullard Co., Bridgeport, Conn. Catalogue covering Bullard's Dynamill horizontal boring machines. Described are tape, headstock, and Depth-Au-Trol spindle-depth control; saddle stops; binders; automatic lubrication; and oil reservoir and drive motor.

Circle Item 557 on Inquiry Card



Photoelectric Control

Cramer Controls Corporation, Electronics Division, Centerbrook, Conn. Bulletin covering an infrared photoelectric control, Infrabeam, which functions by reflected or interrupted beam over a long range, even under high general light conditions.

Circle Item 552 on Inquiry Card



Cast-Tooth Sprockets

Link-Belt Co., Chicago, Ill. Catalogue (Book 2867) listing stock sizes of over 30,000 of the company's cast-tooth sprockets. Basic types included are arm-center, plate-center, segmental-and split-rim sprockets, and traction wheels.

Circle Item 558 on Inquiry Card



Multiple-Tool Machine

Cleereman Machine Tool Corporation, Chicago, Ill. Catalogue No. 860 covering details on the Cleereman Spindlemaster, a multiple-tool machine that drills, taps, bores, reams, and mills through numerical control. Specification charts are included.

Circle Item 553 on Inquiry Card



Motor Mounts

Falk Corporation, Milwaukee, Wis. Bulletin 7100 featuring the company's all-steel Equi-Poised motor mounts, for mounting motors directly to the steel frame of Falk 1/2- to 30-hp shaftmounted, flange-mounted, and screw conveyor drives.

Circle Item 559 on Inquiry Card



Hardness Testers

Wilson Mechanical Instrument Division, American Chain & Cable Co., Inc., New York City. Catalogue RT-60 on "Rockwell" and Superficial hardness testers, and Tukon microhardness testers. Also described are several models designed for specific uses.

Circle Item 554 on Inquiry Card



Lathes

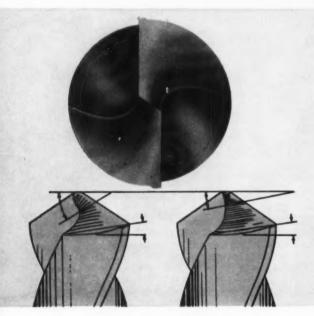
Gisholt Machine Co., Madison, Wis. Catalogue on Gisholt's Masterline machines: manually operated ram and saddle type turret lathes; automatic chucking lathes; Cri-Dan semi-automatic, single-point threading lathes; and superfinishing machines.

Circle Item 560 on Inquiry Card

NEW FOR 1961 OLIVER OF ADRIAN MODEL 600 DRILL POINTER

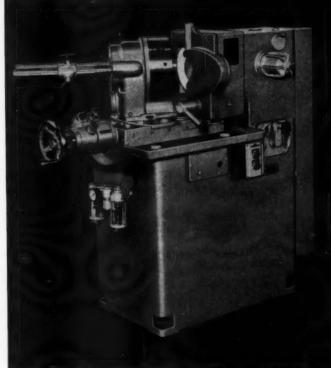
For 40 years, the theoretically perfect Oliver Drill Point has been an industry favorite. Oliver's new drill pointer has been completely redesigned—offers more advantages than ever before! Retaining the thoroughly proven point, the machine has the ability to stand up even longer under rigorous dayafter-day service.

The three versions of the "600" have a capacity of ½" to 3". One is for dry grinding, one for wet grinding, and one is a combination wet grinder with an "airdraulic" automatic infeed for larger drills. Wet grinders are particularly important for drills requiring extensive stock removal. The airdraulic infeed makes the machine 100% automatic after set up (can be operated manually if desired).



Easier Penetration

The proven Oliver Drill Point is known for providing more holes per grind. Less torque—less thrust is needed for penetration. Lower feeding pressure saves on drilling machine repairs, power costs and drills. The Oliver Drill Point is ground to increase clearance as the center of the drill is approached. Each lip does its equal share. The drawing at the right shows a conventional drill point with constant clearance. The one at the left is an exaggerated view of the Oliver point. You can see that the clearance angle increases rapidly as the drill web is approached.



Machine Provides Complete Accuracy

New features of the Oliver Model 600 Drill Pointer are built around the demands for accuracy and trouble-free operation.

- A new scroll-type chuck is incorporated. Moving parts are sealed against foreign material and a recirculating lubrication system and anti-friction bearings assure long life. A dual support center rest assembly provides greater accuracy.
- Variable clearance—approximately six times greater than ever before—is supplied with a new hand wheel control.
- Direct drive to the chuck—no universal joint.
- · Grinds two-, three- or four-flute drills.
- All components are larger and heavier. Controls are in front for simple operation.

Oliver also provides bench model machines for sizes ½" and smaller. A cam-controlled, heavy-duty model grinds the Oliver Drill Point. A standard machine is also available for the conventional point.

Yes, the Oliver of Adrian Drill Pointer is bigger and better than ever. Oliver will sharpen your drills on a "no charge" trial basis. Write for full information—satisfy yourself—then give us an opportunity to quote.

OLIVER of ADRIAN

1410 E. Maumee St. . Adrian, Michigan

DRILL GRINDERS AND THINNERS AUTOMATIC AND MANUAL FACE MILL GRINDERS TOOL AND CUTTER GRINDERS TOOL BIT. GRINDERS CONTOUR SAWING AND FILING MACHINES.

BETWEEN GRINDS

Earth Is Old Hat

Ten years from now, stated an Alcoa executive, air cars, built of aluminum, will be a commonplace means of transportation. They will skim over bulldozed throughways and cross water equally as well as land. Looking ten years beyond that, the executive predicted that man will be able to fly with his personal wing, an aluminum levitator powered by a tiny jet engine no bigger than a coffee cup strapped to his back. We can't wait to see a million or so commuters flapping their way to work in the morning. But if you run into an old friend on your way home, where do you stop off?

Go Global, Young Man

The American steel industry is on a hunt for new sources of iron ore to offset the depletion of the richer deposits in the Mesabi range, according to Steelways. More than \$2,000,000,000 has already been invested in this project over the past ten years, and further expenditures are forthcoming.

Cheaper to Wear a Beret

Did you read about the tall chap (6 feet 4) who bought a Rolls-Royce? His hat kept bumping the car ceiling, so (being both annoyed and wealthy) he had the roof raised 6 inches at a cost of almost \$1600—roughly, \$250 an inch. People with pointed heads might be interested.

Wall-Wise

We were reading in *The Postage Stamp* (a little-larger-than-that house organ of Globe Mail Agency, Inc.) that Bruce Barton, founder of one of the world's largest advertising agencies, has one entire wall of his office covered with a mural showing a large crowd of men and women walking along a street. It is sup-

posed to remind everyone in the agency that goods are bought by nobody except people. We never did believe those shaggy dog stories anyway.

Watts That You Said?

Dr. Howard Hardy, an acoustical engineer who measures noise in watts, decided that the noisiest noise is that of a take-off of a B-52 jet. Comparatively, it is equal to the noise of all the people in the world standing together and talking at once, or 2,790,000 watts. Sounds reasonable when you think in terms of an average cocktail party.

No Shovel for the Hovel

One-minute foxholes are now possible with a digging machine devised by the U. S. Army Engineering Research and Development Laboratory, according to Industrial Research Newsletter.



THE WAY TO WORK-Private quarters for each die-grinder operator at Magnetic Metals Co., Camden, N. J., based on a two-year test period in which skilled workmen used an experimental booth and made suggestions for the best conditions attainable, now provide ideal working conditions and foster company loyalty. Seen in the picture is one of the soundproofed, airconditioned booths, with nameplate on door, radio on desk, and large picture window (to counteract any feeling of isolation). An added charm-grinders can better hear the "kiss" of the grinding wheel as it contacts the tungsten carbide from which the company makes most of its precision dies.



NEW Allen-Bradley Relay with EXCLUSIVE Permanent Magnet Latching



Saves Panel Space

Gives Millions of Trouble Free Operations

Holds Closed Without Coil Current

Two to Six Poles

Bulletin 700

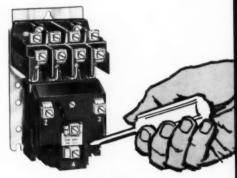
TYPE BRM

Here's a completely new "latching" relay—which does not use a mechanical latch! It is the Bulletin 700 Type BRM—built to provide the same millions of dependable operations you get from all Allen-Bradley's industrial relays. A "built-in" permanent magnet eliminates the mechanical latch and the usual troubles caused by mechanical linkages.

When the coil of the new Bulletin 700 Type BRM relay is energized, the relay closes and is held closed after the coil circuit is opened—by a permanent magnet. Energizing the coil in opposition to the permanent magnet field opens the relay. The correct polarity for operation of the relay is obtained from silicon diodes held within the molded coil cover. With no "piggy-back" additions out in front, and no "extra" solenoids below, the Type BRM relay saves valuable panel space.

These A-B Type BRM relays also feature a continuous duty coil that permits the current to be left on, if desired. As with all Allen-Bradley relays, the double break, silver contacts never need attention. And the contacts of these new magnetically latched relays afford the same 60-second convertibility of the popular Bulletin 700 Type BR relay.

For latching relay service, it will pay you to investigate this new and completely different relay. It provides the usual Allen-Bradley quality!



Can be latched or unlatched by hand

ALLEN-BRADLEY

Member of NEMA

Allen-Bredley Co., 1816 S. Second St., Milweutee 4, Wis. • In Canada: Allen-Bredley Canada Ltd., Sait, Ont.

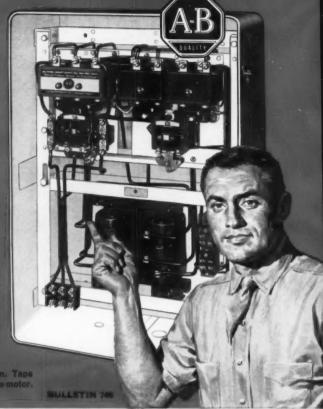
QUALITY MOTOR CONTROL

Where Reduced Voltage **Motor Starting** is Necessary...

Allen-Bradley has the best and most complete answer

No matter what your reason for reduced voltage motor starting may be, Allen-Bradley has the right starter. Not only can the power company's requirements be satisfied exactly, but the A-B starter will at the same time provide the best possible starting conditions for the motor and the driven load. At least one of the starters described below will completely satisfy your operating requirements. For more detailed information, send for Publication 6088.

AUTOMATIC AUTOTRANS-FORMER starter for squirrel cage motors that should not be started at full voltage. The autotransformer reduces line voltage during acceleration. Taps permit adjustment of voltage applied to the motor.





BULLETIN 540

MANUAL RESISTANCE

starter has graphite compression disc resistors for velvet smooth starting of squirrel cage motors. Starting of the motor is under the complete control of the operator.

BULLETIN 740

AUTOMATIC RESISTANCE starter has graphite resistors automatically inserted in series with the squirrel cage motor at starting. Resistors can eas ily be adjusted to motor and load conditions, giving velvet smooth acceleration.



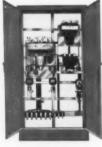
BULLETIN 646

MANUAL AUTO-TRANSFORMER starter for use

where load conditions or power company rules require reduced voltage starting. The air break starter shown has double break, silver alloy contacts.

AUTOMATIC RESISTANCE

starter for use on network systems. Resistors inserted at starting are cut out in definite steps. Time intervals adjustable to provide velvet smooth starting.



BULLETIN 741

AUTOMATIC STEPLESS RESISTANCE

starter is not equalled for velvet smooth motor acceleration. It will satisfy any power company require-ment. Eliminates lamp flicker on networks used for power and lighting.



BULLETIN 742

AUTOMATIC PART WINDING starter for use with

squirrel cage motors having two separate parallel windings. Made in two-step type, and three-step type with resistance connected in the line on the first step.



BULLETIN 736

ALLEN-BRADLEY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

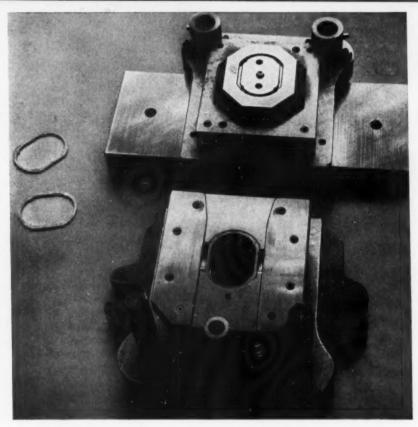
QUALITY MOTOR CONTROL



Tool Steel Topics



one of the first of the contract of the contra



Blanking die output up 300 per cent when they changed to Bearcat tool steel

Bearcat is the major grade of tool steel in this compound die which blanks and pierces an automotive piston strut at Art Stamping, Inc., Cincinnati. The die, hardened to Rockwell C57-59, was fed slugs of .075-gage C1035 hot-rolled steel. With the tool steel formerly used, an average of 115,000 pieces was produced. But with the change to Bearcat, more than 500,000 pieces were obtained before die failure. That's really cutting costs!

Bearcat is our super grade of shock-resistant tool steel. And it has plenty of wear-resistance for long runs. An air-hardening grade, it minimizes quenching hazards and distortion in heat-treatment.

Bearcat is ideal for blanking and forming dies, hot headers, shear blades, punches, and die-casting die inserts. In fact, it's right at home in any application calling for unusual toughness.

If you would like to put Bearcat to work in your shop, get in touch with your Bethlehem tool steel distributor. He has Bearcat in stock, in a wide size range. Give him a call today.

BETHLEHEM TOOL STEEL ON ENGINEER SAYS:



Lehigh H Still the Best Non-Distorting Tool Steel

Many of today's new tool steel grades are air-hardening types, such as Bethlehem's Bearcat and Air-4. Tests on these new air-hardening grades invariably show relatively low distortion in heat-treatment. Measurements on small test pieces, or on specific tools, often show size changes, resulting from hardening, of about .0002.0004 in. per in. But due to overenthusiasm, such results are often interpreted—and incorrectly—to indicate that the grades themselves are the long-sought "non-distorting tool steels."

However, tests on specimens of a variety of sizes and shapes show that individual dimension changes vary from zero to about .001 in. per in., averaging .0006-.0007 in. per in.

Production tools made from all medium alloy air-hardening tool steels will show low distortion to a degree which may eliminate many problems encountered with oil- or water-hardening tool steels.

When considering the low distortion of these steels, remember that Lehigh H (AISI D-2) has even lower distortion. Furthermore, the distortion resulting from heat-treatment of tools made of Lehigh H is both predictable and controllable, even to zero distortion; if required. This can be accomplished by the austenite-martensite balance method described in Bethlehem's tool steel catalog.

Such medium alloy air-hardening tool steels as Air-4, A-H5, and Bearcat are good performers on distortion. But Lehigh H is the best of all.

Optional Nonmetallic Ways for Planer Table

Nonmetallic table ways, available as optional equipment on the new Flying Scot small planer (Fig. 1) made by the G. A. Gray Co., Cincinnati, Ohio, are said to increase the load-carrying capacities 100 per cent over the maximum available with cast-iron ways. The higher cutting and return speeds of these ways are also claimed to substantially increase planer productivity, and result in greatly reduced planing costs.

These nonmetallic table ways exhibit remarkable bearing table characteristics. They consist of laminated plastic plates cemented and pinned to the table ways (see Fig. 2). Higher cutting and return speeds are achieved because heat generated at the bearing surfaces of the vees is virtually eliminated. In addition, metal running on plastic also eliminates cutting and scoring of the bed.

The Gray Flying Scot is essentially a low-priced planer designed and built for modern, fast carbide planing. Single or double cutting heads are available in any combination. The new planer features rugged, square-locked components throughout, engineered to resist torsional deflection and vibration produced in double cutting. A pendant station affords complete control.

Circle 593 on Readers' Service Card

Spray Lubricating System

An innovation in spray lubrication of industrial gearing has been announced by Farval Division, Eaton Mfg. Co., Cleveland, Ohio. This system and its equipment have been developed for use where frequency of lubricating single, heavy-duty gears is no problem but inaccessibility presents a danger to maintenance personnel. The versatile spray system offers an inexpensive means of eliminating the hazards and at the same time provides an efficient method of lubrication.

Dependability of the new spray system is assured by the simplicity of its operating principles. With a

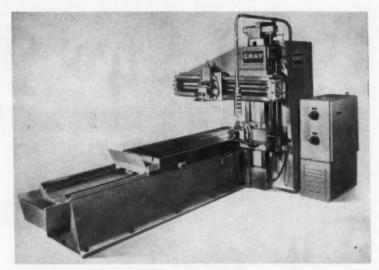


Fig. 1. Flying Scot planer equipped with G. A. Gray nonmetallic table ways

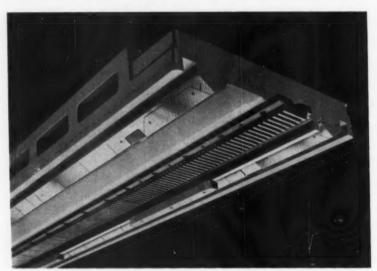
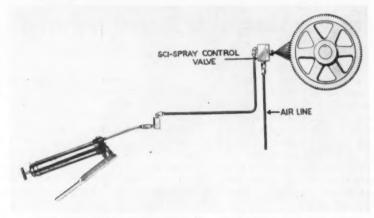
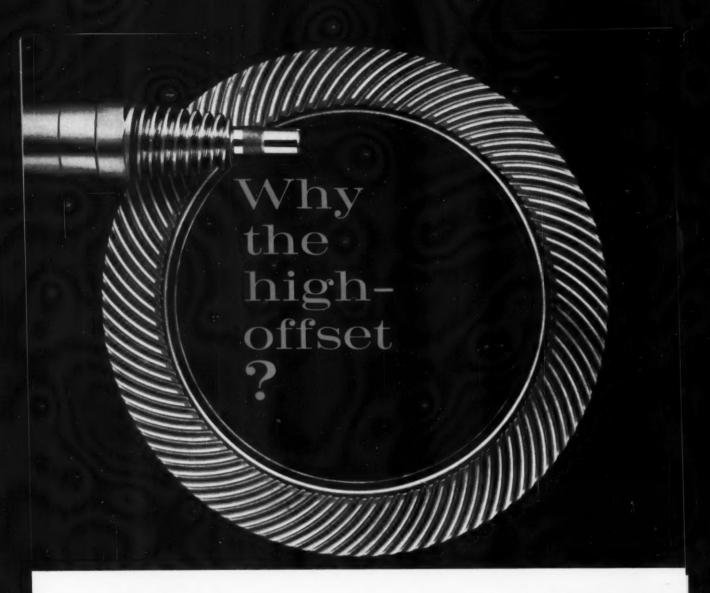


Fig. 2. View of underside of planer table of machine shown in Fig. 1



Farval spray lubricating equipment for servicing gears in danger zones



...and where can you use it profitably?

High-offset makes a difference!

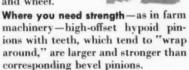
It's the difference that lets you combine high-reduction with strength, compactness and other advantages you might find profitable in certain applications. For instance . . .

For smooth operation-as in office

equipment that must run quietly -high-offset pairs provide smooth, quiet tooth action. Because the teeth "wrap around"

the pinion, you get continuous action-even with just one or two teeth.

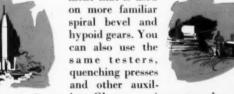
Where space is a problem-as in instrumentation-the high-offset lets you design a more compact unit. Choose just the offset to solve your design problem with a more flexible, more compact unit than the corresponding worm and wheel.



High-offset or high-ratio hypoids can be cut on the same Gleason equipment that is used

iary Gleason equipment you're using now. Grinders are available for applications requiring precision finish. For ratios of 1:10 or 1:40 or even higher.

Get more information by writing for free literature. Submit your prints for recommendations.





1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

hand grease gun attached to a conveniently located fitting, lubricant will be sprayed as long as pumping is continued. Lubricant pressure forces down a spring-loaded piston, opening ports leading to the Farval spray-control valve. This allows air and lubricant, each under its separate pressure, to be forced through the spray nozzle. When lubricant flow ceases, the piston returns to its original position, closing the parts. The air supply is then shut off, limiting compressed-air consumption to the amount needed for each delivery of oil or grease.

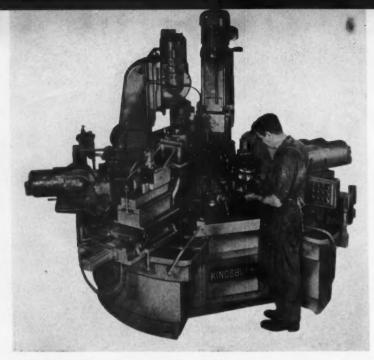
Circle 594 on Readers' Service Card

Kingsbury Automatic Machines Aluminum Cover for Parking Lock

Seven units with twelve spindles mill, drill, tap, and ream an aluminum cover for parking locks at a gross rate of 340 parts per hour. The 30-inch index-table of this machine, built by the Kingsbury Machine Tool Corporation, Keene, N. H., holds seven double-chucking work-fixtures.

For the first chucking, the operator places the work in the top left of the fixture and moves the front clamping handle. The flat surface of the work is on top, and two holes fit over locating pins. Four clamps with equalizing action hold the work in place.

In this chucking, two vertical units drill and tap one hole and ream two holes. At the left is a motorized spindle that feeds horizontally on a hydraulic slide to mill the top face at 3500 rpm. Two more horizontal units drill and



Multiple-spindle automatic built by Kingsbury Machine Tool Corporation

tap one hole and ream two holes.

For the second chucking, the operator places the face just milled against the right side of the fixture and uses the top clamping handle. The two holes just reamed fit over locating pins. A cam in the fixture actuates a jaw that clamps the work to the left. In this second chucking, the vertical units step-drill and tap one hole. Two of the horizontal units step-drill and step-ream one hole. The last unit, mounted right, mills a slot.

Circle 595 on Readers' Service Card

small-area index setups. These fixtures take 3 C collets. Their small size will allow close grouping of several fixtures on small indextables. The horseshoe type handle has a hardened operating-cam button. The height is 2 3/8 inches and the flange area covered is approximately 3 3/8 inches in diameter. Standard, small press, chucking, milling, tapping, and other machines can be tooled easily with a number of these fixtures.

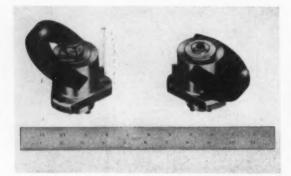
Circle 596 on Readers' Service Card

Collet-Holding Fixtures

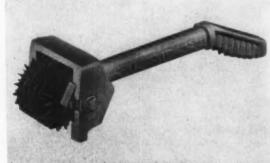
Zagar Inc., Cleveland, Ohio, has announced a new line of colletholding turntable fixtures for

Grinding-Wheel Dresser

Machine Products Corporation, Dayton, Ohio, has added a No. 22 heavy-duty grinding-wheel dresser to their present line. This new



Collet-holding turntable fixtures announced by Zagar Inc.



Machine Products heavy-duty grinding-wheel dresser





Fosmatic numerical control is also available on Moore-Fosdick jig grinders.

FOSMATIC N/C PRECISION BORING MACHINES

Four models from the compact "32" with 18" x 30" table travel, to the big "54" with 28" x 48" travel. All available with Fosmatic electro-mechanical tape control for table position, spindle depth, head height, speeds, feeds, and tool changing. Fosmatic control positions workpieces accurately to \pm .0001". Fosmatic jig borers make provision for numerical control in the basic design and can be furnished in any degree of automation.

Get a proposal from

The Feedick Machine Tool Co., Cincinnati 23, Ohio

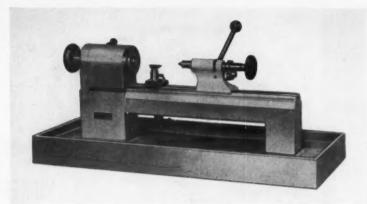


dresser has 2 3/8-inch-diameter cutters and a 2-inch cutting face. It features an improved six-set bearing assembly which furnishes six bearing holes, eliminating wear on the cutter-head of the "pistolgrip" handle. The bearing blocks are easily indexed to present new bearing surfaces. Their hardened edges protruding from the dresser head prevent the grinding wheel from hitting the handle casting, and grinding away the bearing surfaces. The dresser is suitable for use on all medium and large wheels.

Circle 597 on Readers' Service Card

Vacuum Coolant Filters

A line of vacuum coolant filters designed to clean dirty coolant at high flow rates has been introduced by the Barnes Drill Co., Rockford, Ill. These filters, in five models with capacities ranging from 150 to 1000 gpm, have two types of cleaning action. When dirty coolant enters the tank, heavy particles settle to the bottom and are removed by a drag conveyor. The vacuum portion of the unit then cleans the coolant to any degree required by the installation. Filtering is performed by a fabric that winds around a mesh drum. The drum is immersed in the dirty-coolant tank. A vacuum pulls the coolant from the dirty-coolant tank, through the



Levin instrument lathe

fabric to the inside of the drum. The clean coolant is then pumped into the clean-coolant tank.

For installations requiring a high degree of coolant clarity, an optional diatomaceous-earth body feed may be added to the filter. The filter operates without interruption for a blow-down cycle. New fabric automatically indexes onto the drum when the vacuum reaches a predetermined point or when the coolant rises above a certain level.

Circle 598 on Readers' Service Card

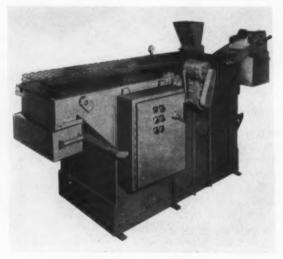
Instrument Lathe

Louis Levin & Son, Inc., Los Angeles, Calif., has introduced an instrument lathe with a collet capacity of 1/2 inch. It is intended for use on parts that are fairly large. The enclosed headstock is belt-driven by a 1/4-hp motor provided with a stepless speed control. Spindle speeds from 0 to 4000 rpm are obtained. A footswitch is used for starting and stopping, as well as controlling a coolant pump, which is optional. The lathe incorporates the same sensitivity as the other Levin lathes, and uses all the standard accessories.

Circle 599 on Readers' Service Card

Engelhard Furnace-Atmosphere Analyzer

Accurate measurement and continuous monitoring of trace quantities of oxygen and moisture in special gas atmospheres can be



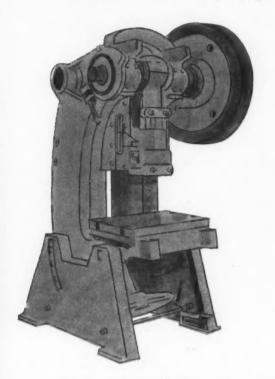
Vacuum coolant filter manufactured in five different capacities by the Barnes Drill Co.



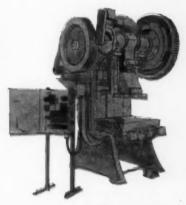
Engelhard furnace-atmosphere analyzer for measuring trace quantities of oxygen and moisture

Federal's dependability assures lower production costs-longer press life!

7 TO 125-TON CAPACITY







FEDERAL DIAL FEED PRESSES

Up to 20 multiple station operations — up to 300 indexes per minute. Hardened and ground indexing cam assures accuracy and smooth operation. Available with automatic parts-feeding and ejecting devices. Gear or chain driven. Safety mechanism protects dies.

FEDERAL AIR-CLUTCH PRESSES

The new Federal Friction-type Air Clutch is designed specifically for presses. Flywheel mounting reduces mass to be put into motion. Fast engaging and disengaging at any speed. Uniform torque distribution — shock-free engagement. Fail-safe operating controls.

FEDERAL GIVES YOU MORE!

Every Federal is built to your specifications with the highest quality materials, and Federal's well-known precision workmanship. The result — dependable service...lower production costs, and longer press life, even under the most rugged conditions. Check the quality features at the right. Then check with Federal on your next press requirements.

QUALITY FEATURES

- Meehanite Cast Frames
- Replaceable Bronze Bushings
- Magnaflux Inspection
- Oversized Crankshaft Bearings
- Front-operated Recline
- Longer Rams and V-ways
- Exclusive Non-repeat Clutch Mechanism
- Timken Roller Bearing Flywheels

NOTE: Federal's reputation for service is equally well-known, and most orders for Genuine Federal Parts are shipped the same day.



open-back inclinable

PRESSES



Horizontal Presses



Flying Cutoff Presses



Extruding Press



Dial Feed Presses

THE FEDERAL PRESS COMPANY of Elkhart, Indiana, Dept. 90

performed with a portable furnace-atmosphere analyzer introduced by the Chemical Division of Engelhard Industries, Inc., Newark, N. J. The analyzer is designed particularly for producers of the so-called exotic metals, semiconductor materials, and various electronic devices—all of which are frequently manufactured, processed, or stored in protective atmospheres.

Principal applications of the Engelhard analyzer are in heattreating and crystal-growing furnaces, storage dry boxes and assembly facilities used in the manufacture of semiconductor materials, transistors, and other electronic devices in which the pickup of even minute quantities of undesirable impurities may have serious effects on performance and useful life. Certain other processes require moist oxidizing atmospheres to produce properly oxidized metals for glass-to-metal seals, and here again knowledge of the precise gas composition is desirable for optimum quality control. In addition, the analyzer will prove useful in the processing of various metals, such as titanium and zirconium, for applications in fields other than electronics.

Circle 600 on Readers' Service Card

"Adjustable-V" Outboard Work Supports

Tru-Grind Adjustable-V outboard supports for all makes, types, sizes, and models of centerless grinders are being introduced by the Livingston Tool & Development Co., Belmont, Calif. This patented equipment consists of two complete Adjustable-V outboard supports, brackets, and soft jaws (to prevent scratching on output side). The illustration shows the support for the entering side. A similar adjustable support is provided for the output side. Brackets for these supports are made to suit the particular machine on which they are to be applied. The supports are available for through-feed and spot or plunge grinding of all kinds and lengths of material.

Circle 601 on Readers' Service Card

Sliding-Bolster Presses

Sliding bolsters designed to reduce die change-over time from hours to minutes are available on inclinable, straight-side, and other presses, both large and small, built by the Niagara Machine & Tool Works, Buffalo, N. Y. Because the dies glide or float on a cushion of air, they can be quickly moved into or out of the working area. A power-operated slide adjustment permits the ready duplication of previous die settings. Hydraulically actuated die clamps maintain the clamping load mechanically in case of hydraulic or power failure.

The accompanying illustration shows a Niagara Series E5 1/2 open-back inclinable press equipped with sliding bolster. With this equipment, the die for



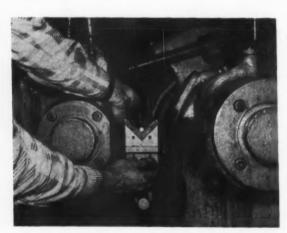
Niagara open-back inclinable press with sliding bolster

the first operation can be replaced with the one for the second operation in fifty-two seconds.

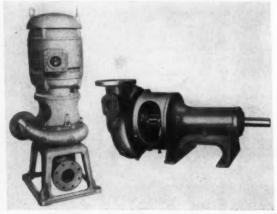
Circle 602 on Readers' Service Card

Fairbanks-Morse NEMA-Matched Pumps

Fairbanks, Morse & Co., Pump and Hydraulic Division, Kansas City, Kan., is introducing its new line of Adapt-Able centrifugal pumps, designed to handle a wide range of clear-water, nonclog, and other liquid pumping jobs. Each pump in this line is NEMA-matched; that is, its dimensions align with those of the corresponding NEMA-rated motor. This facilitates mounting and trouble-free operation. These pumps are



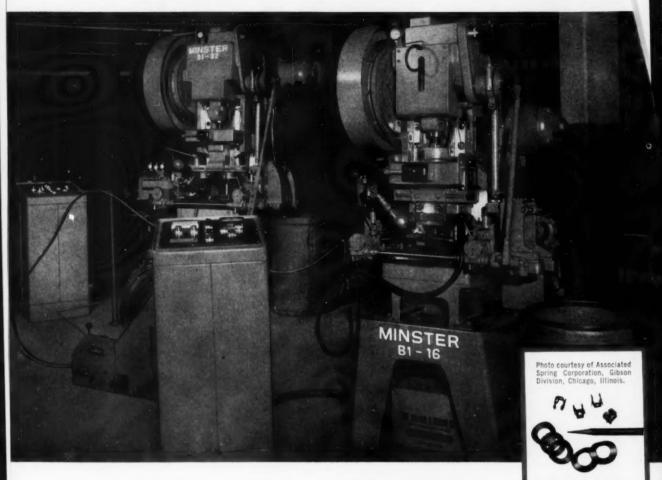
Outboard support for centerless grinding machine brought out by Livingston Tool & Development Co.



NEMA-matched vertical and horizontal pumps introduced by Fairbanks, Morse & Co.

AUTOMATIC PRODUCTION

is faster, more accurate, more profital



Minster B1 High Speed Gap Presses

You gain in many ways when you run single or multi-stage jobs automatically at high speeds. You increase production and slash costs. Less equipment is needed, cost per part is lower and that means more profit.

Automatic production is always most profitable when you take advantage of Minster's technical knowledge and wide range of presses and feed equipment. Minster matches the proper type and size of press and feed to your requirements . . . gives you maximum versatility in material size and job selection.

Minster B1 High Sp

Gap presses range in capacity from 16 to 60 tons.

They're compact and

highly efficient for long or short run small parts

production from coll

Let us show you the best way to run your jobs automatically—at greater profit. Write or call today.

The Minster Machine Company . Minster, Ohio





constructed so that their frames receive various-size volutes and impellers. Thus, each individual pump becomes, in effect, the equivalent of several units.

The pumps are designed to permit the most economical frame size to be selected to match the motor horsepower requirements of the pumping job. In vertical pumps, such as shown at the left in the illustration, the Adapt-Able design offers split-case advantages in which rotating elements are separated as a unit, simply by removing a few bolts connecting the adapter to the volute, then lifting the assembly free.

The pumps are available in both conventionally mounted horizontal and vertical pump and motor units, as well as the Fairbanks-Morse "biltogether" construction.

Circle 603 on Readers' Service Card

Milling Cutters with Micro-Finishing Blades

Micro-Finishing blades designed for smoother finish milling with throw-away insert carbide milling cutters have been developed by the Wesson Co., Ferndale, Mich. The new blades are intended for use with Wesson's recently announced cam-pin milling cutters designed for precisely locating inserts axially. By replacing just one of the square inserts in a Wesson throw-away insert milling cutter with the new Micro-Finishing blade, smoother finish milling is possible. Cutters with one of these new blades are said to give surface finishes consistently below 50 micro-inches.

The new blade is inserted in the



Standard blade of Wesson campin milling cutter replaced by Micro-Finishing blade

slot with the least amount of runout so that it can be positioned anywhere within the adjustment range (0.030 inch) of the cam-pin. The Micro-Finishing blade cutting edge is parallel to the cutter flange (at right angles to the spindle) and tends to wipe away cutter marks. In addition, the new blade compensates for spindle misalignment because the length of the cutting edge is greater than the cutter advance per revolution. Micro-Finishing blades are now available for all Wesson cam-pin cutters using 3/4-inch square throw-away inserts.

Circle 604 on Readers' Service Card

Pic Direct-Reading Gear-Teeth Counter

The Pic Design Corporation, a subsidiary of Benrus Watch Co., Inc., Long Island, N. Y., is offering a "patented" direct-reading gearteeth counter, available from stock. This counter is designed for all users of fine-pitch gears, particularly those who stock various types of precision gears which may not be properly labeled.

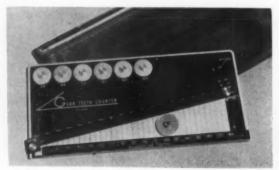
The selected gear is first checked for pitch. If unknown, the gear is engaged with each of the test gears on the panel, until proper meshing indicates the correct pitch -48, 64, 72, 80, 96, or 120. The adjustable sine bar is then set for the indicated pitch by inserting the pin in the proper hole on its free end, thus forming an angle or wedge with the straightedge carrying the "number of teeth" scale. The gear is slipped into the wedge area and shifted towards the apex of the wedge until the gear binds. The number of teeth is then read directly on the vertical scale line immediately to the left and tangential to the gear.

Each vertical line of the calibrated scale represents the spacing of one tooth. By inserting a gear of one tooth less, being correspondingly smaller, it will read to the next line on the scale, or one tooth less. Now, instead of having to count each tooth of a gear, in some instances totaling up to 180 teeth, the precise answer is obtained in seconds with the new gear-teeth counter.

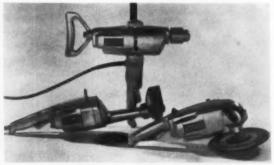
Circle 605 on Readers' Service Card

Stanley Line of Portable Power Tools

A line of sixteen completely new portable power tools for industrial use has been announced by Stanley Electric Tools, division of the Stanley Works, New Britain, Conn. The line includes ten heavy-



Direct-reading gear-teeth counter brought out by the Pic Design Corporation



Three of the sixteen portable power tools in the new Stanley Electric line

High electrical conductivity PLUS machining savings like this — with Anaconda Leaded Copper-126



55% SAVING in production time PLUS savings in longer tool life-cutters, 400%-drills, 33%-taps, 33%.

Scores of electrical components made by Barkelew Electric Mfg. Co., Middletown, Ohio, specialists in the manufacture and development of high-capacity switching equipment for over 50 years, require high electrical conductivity in service and considerable machining in manufacture. The figures above for a clip assembly typify the savings made possible by the use of Anaconda's high conductivity Leaded Copper-126. Other applications include pieces machined from bar stock as large as $4\frac{1}{2}$ " x 2". Leaded Copper-126 is available

in standard mill forms. For more information, see your Anaconda representative — or write: Anaconda American Brass Co., Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.



Anaconda American Brass Company

duty drids, in a range of 1/2-, 3/4-, 1-, and 1 1/4-inch sizes; three heavy-duty disc sanders in 7- and 9-inch sizes; a 7-inch polisher; and two portable grinders in 5- and 6-inch sizes. These tools are said to be up to 35 per cent lighter in weight and up to 100 per cent more powerful than preceding models. They have been designed for operation with a minimum of effort through precision balance, better control, greater durability, and lighter weight. The "soft square" shape identifies them with

the other products in the Stanley Electric Tools line.

Features include: a new type fan that provides extra-high-speed air flow through the housing for maximum ventilation and minimizes accumulation of dust and abrasives; handles engineered for maximum control and balance; and contoured, comfortable, mansized grip designed to control the extra cutting force or torque built into each tool. Sealed integral trigger switches are completely self-contained. There are no screws

to turn and no springs to become lost. Felt seals lock out abrasive dust and prolong switch life.

All trigger switches have locking pins within finger-tip control. Exclusive "window" brush holders reveal brush wear without removing brushes from holders. One screw holds commutator covers.

Circle 606 on Readers' Service Card

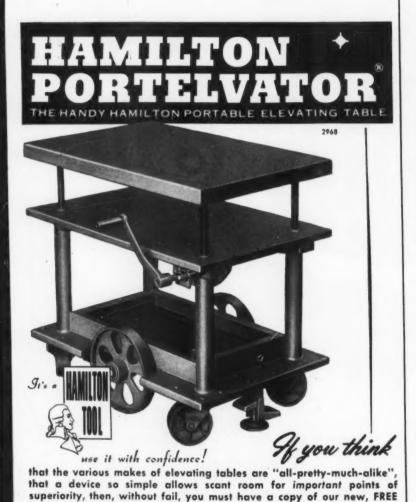


Set C, largest of three new Super-Mike stub boring tool sets announced by Davis Products, Giddings & Lewis Machine Tool Co.

Davis "Super-Mike" Stub Boring Tool Sets

Three versatile stub boring tool sets specially selected to fulfill the majority of boring requirements in a range of 7/16 to 18 inches are announced by Davis Products, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. Each set comes in a steel case for use right at the machine, thus eliminating time-consuming trips to the toolroom. All three sets contain Davis "Super-Mike" precision microm-eter-adjustable fly-cutter bars and tooling. The Super-Mike feature permits positioning of cutters in the bars to an accuracy of 0.0001 inch and eliminates the need for cut-and-try toolsetting on closetolerance work.

These new sets have bar diameter-to-length proportions for maximum cutting performance and can utilize SHSS, TCT, or the new Davis throw-away insert Super-Mike cutters. Davis continuous-feed heads—for boring, facing, turning, counterboring, backfacing, grooving, and chamfering operations—also are included in the two largest sets. These heads provide continuous radial tool feed

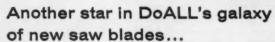


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TOOL COMPAN

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The Dart.

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your money back!

COSTS only
PENNIES MORE
to SAVE DOLLARS
in
PERFORMANCE



Another reason for Darf saw band superiority is the exclusive DoALL welding process that guarantees the strongest saw band weld made—and perfectly matched teeth. Darf blades are sold in custom welded lengths—ready for use on your machines. Set is guaranteed to be accurate within ± .002 in. and to be perfectly balanced for long, accurate exercises.

ATTENTION ... CUT-OFF SAW USERS

Here's good news for all operators of band sawing machines using carbon steel blades. The new *Dart* saw band is engineered to outperform any and every other make of carbon steel saw bands. Why? Only *Dart* has the specialized heat-treatment that gives it a spring-tempered back with a full hard cutting edge. Only *Dart*, created by the finest saw band making know-how in the entire industry, has the cutting ability, accuracy and life you want to cut sawing costs.

Try the new *Dart* saw band without delay. Remember: If it doesn't cut more accurately and longer than any other carbon steel blade, you'll get your money back. Call your local DoALL Sales-Service Store today.



and have a working range of 7/16 inch (with pencil boring tool) to either 10 or 18 inches, depending on size of the head.

Circle 607 on Readers' Service Card

Submersible Motors

A completely new line of submersible alternating-current motors has been introduced by Reliance Electric & Engineering Co., Cleveland, Ohio. These pressureproof motors are especially designed for close coupling to centrifugal pumps operating in any depth of water, oil, or liquid chemicals. They are now available in sizes from 1/2 through 40 hp for operation from polyphase power sources, and from 3/4 through 5 hp for single-phase connection.

The motors are rated at 55 degrees C. temperature rise for thirty-minute duty in 40 degrees C. air, and for continuous duty in 40 degrees C. liquids. The heavy one-piece, ribbed housing of the



Fig. 1. Reliance pressureproof submersible alternating-current motor

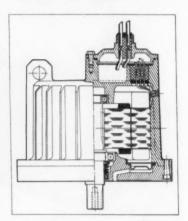
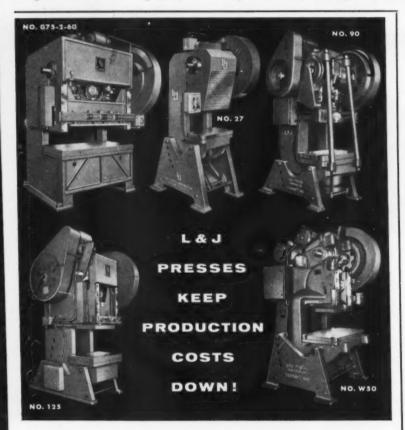


Fig. 2. Cutaway view of submersible motor shown in Fig. 1

new motors (see Fig. 1) is leakproof. Both the cast-iron motor frame and mounting base are impervious to corrosion.

Of "Liqui-Seal" construction, as shown in Fig. 2, the motors are oil-filled to give total protection against bearing wear. They never need additional lubrication. The leakproof construction seals in the motor oil as it seals out foreign contaminants. The "heart" of the construction is a specially designed neoprene diaphragm with a built-in O-ring, which completely encircles the motor base to disperse pressure differences over a large area. If internal and external pressures differ, due to heat or depth of immersion, the diaphragm flexes slightly to neutralize the pressure, thereby relieving pressure build-up around the O-ring and positive shaft seal.

A reconnectable dual-voltage





There's a good reason why L&J Presses can do this—they are engineered for it. Each year sees new techniques in metalworking, and each year sees more improvements in L&J Presses to match them to user's requirements. Advancements in basic design, metallurgy and components continue to provide increased efficiency and dependability needed to keep metalworking costs down.

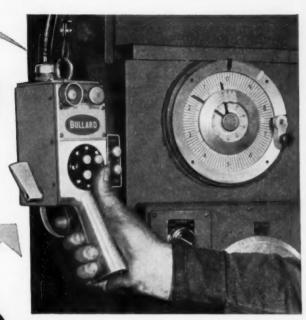
Now is the time to find out what these highly improved L&J Presses can do for you. Write for catalog of 14-to 150-ton O.B.I. Presses, 20- to 150-ton Straight Side Presses and 30- to 75-ton Gap Frame Presses...a size and type for most press requirements.



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Lower Costs - Increase Profits with

CENTRALIZED POWER CONTROL



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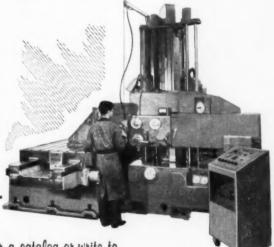
BULLARD

DYNAMILL* H.B.M.

Large, easy to read clock-type dials allow the operator to "power" position the head, table, saddle and spindle in relation to the work piece without the use of hand cranks or levers. These dials, when the machine is equipped with numerical control, provide an accurate, instantaneous visual read-out on the positioning of the system.

Simple push buttons on the control pendant direct all motions of the head, table, saddle and spindle. Spindle start and stop, as well as spindle speed changes, are controlled from buttons on the pendant. Four traverse rates and feed engagement are actuated by the operator's forefinger on the pendant trigger.

Thus, within the span of a man's hand, are centralized power controls which allow the operator to keep the tool in the cut more of the time — thereby reducing costs and increasing profits.



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*Trade Mark



means a complete piece . . . at each index cycle

When a piece is finished it is completely finished without the necessity of a second operation. Furthermore it means more finished pieces in a given period of time and greater accuracy in every finished piece.

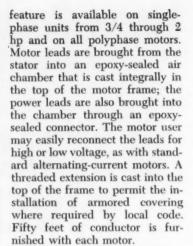
The "1-2-3" Method is exyou to investigate.

clusive with Goss & De-Leeuw. With it, three ends of a piece can be machined at a single chucking of the work, simultaneously or in sequence depending on the operations involved. It will pay

Send for illustrated literature Send for illustrated interature giving detailed information, Send samples and ask us to give you cost estimates of handling this work on a "1-2-3" Goss & DeLeeuw Automatic



MACHINE COMPANY, KENSINGTON, CONN., U.S.A.



The bases of all Reliance submersible motors are precisionmachined for true shaft concentricity. This provides easy, vibrationless close coupling to the pump with no bothersome alignment problems. The impeller mounts directly on the motor shaft, which serves as the pump shaft. The special universal mounting flange fits most standard pumps, and modifications can be made to meet special dimensional requirements. The pump-and-motor assembly can be lowered into position as a single compact unit. Integrally cast rings at the top edge of the frame permit convenient, balanced handling.

Circle 608 on Readers' Service Card



Seneca Falls Power Drive

Mechanical power amplifier designed for applications requiring higher horsepower ratings to move heavy loads introduced by the Seneca Falls Machine Co., Electronics Division, Seneca Falls, N. Y. This No. 13TAA0024 power amplifier is said to provide up to two and one-half times greater torque than previous units, and will amplify the 1/30-hp output of a low-powered two-phase servo motor to deliver and control up to 4 hp. It transmits continuous power over a 50-to-1 ratio speed range, with greater ranges available for special applications, and will amplify torque from any control input device. Its dynamic response characteristics permit the design of high-sensitivity control systems. The external cooling system recirculates oil in the box throughout the housing to dissipate heat and give high continuous power ratings.

Circle 609 on Readers' Service Card



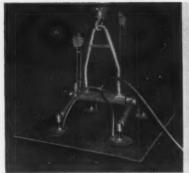
Wilson Compacting Press

Vertical, self-contained, opposedram, automatic-cycling hydraulic press designed to be used for compacting or briquetting of refractory materials, abrasives, and powder metals built by K. R. Wilson, Inc., Arcade, N. Y. This machine is built for continuous automatic high-speed operation, with the operator taking care of piece removal and filling of the hopper. The press has a maximum capacity of 100 tons. Features include continuous oil filtration and cooling by water. Automatic, spray type die lubrication is provided and incorporated into the press cycle, with spray-dwell timer and



cycle counter, to control duration and frequency of lubrication. Platens are 24 by 24 inches with 10-inch diameter hole in stationary platen. Stroke of top ram is 10 inches; daylight, top ram to platen, 16 inches; working height, 42 inches; stroke of charge box, 20 inches: stroke of bottom ram, 6 inches; and depth of fill, adjustable to 4 inches. A 30-hp motor pumping unit powers the twopressure system.

Circle 610 on Readers' Service Card







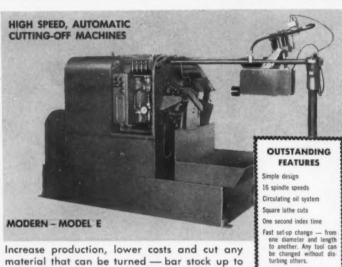
A vacuum hoist attachment with a lifting capacity of 100 pounds has been announced by the Vac-U-Lift Co., Salem, Ill., a division of the Siegler Corporation. It is used for lifting sheets and panels in a horizontal position and stacking them vertically. The attachment is constructed of aluminum tubing, has four neoprene rubber pads, and weighs only 40 pounds. It is designed for use in conjunction with the Vac-U-Lift Powerpac and hoisting facilities.

Circle 611 on Readers' Service Card



Lincoln Electric Arc Welder

One of a complete line of new three-phase rectifier direct-current arc welders for general use in production, structural, and maintenance welding announced by the Lincoln Electric Co., Cleveland, Ohio, The Idealarc R3M series, designed to NEMA industrial standards of 40 volts, 60-percent duty cycle, incorporates highly efficient silicon rectifiers to produce direct-current output in four sizes: 300, 400, 500, and 650.

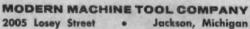


material that can be turned - bar stock up to 3" O. D. — tubing up to 8" O. D., to lengths from a fraction of an inch to several feet, with micrometer accuracy. Ideal for use with carbide tools.

We also engineer and build machines using the same bodies and spindles — for such operations as trimming ends of drawn shells and filler caps. Send prints for quotes.

> We can furnish special tooling to meet your rerequirements — to cut-off, form, groove, flange and chamfer in a single operation, at a high rate of speed. Send prints.







FREE TRIAL OFFER. Safe, positive, fast set-ups. The Modern Safety Drill Table handles odd, irregular shapes without V-blocks, clamps or parallels. Ideal for maintenance work. anteed to save its cost in labor alone every 6 months. Sizes from 8" to 27½" dia. Try it at our expense. No obligation.

All cams, adjustments and working parts for cross slide are outside for quick, easy adjustment.

Chip pan slides out, for easy

Power, speed and rigidity

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pecial spindle bearing takes all collet thrust. No thrust on main taper roller spin-

dumping.

dle bearings.



Output characteristics of the rectifier design have been specifically engineered to prevent electrode sticking on low-current, small-diameter electrode applications. At high-amperage settings the unit maintains a smooth, quiet are transfer. The front panel contains the current control for continuous adjustment of full-range output without making intermediate range changes. Electrode and groundcable mounting studs have been recessed into the front panel and equipped with strain lugs to prevent damage from impact or cable tugging. Standard equipment includes a polarity switch for reversing current flow without changing cable connections.

Circle 612 on Readers' Service Card

Starrett Micrometer Depth Gage

Micrometer depth gage of new series introduced by the L. S. Starrett Co., Athol, Mass., which features a short half-base designed to facilitate depth gaging close to shoulders or between obstructions where ordinary full-base gages cannot be used. It is available in three size ranges-0 to 3 inches with three rods, 0 to 6 inches with six rods, or 0 to 9 inches with nine rods. Sleeve and thimble on these No. 443 series micrometer depth gages have no-glare satin-chrome finish. Graduations are in thousandths of an inch. The screw is precision ground with a 1-inch movement and the base is hardened, ground, and lapped.

Circle 613 on Readers' Service Card





Allen Hex-Key Kits

One of two new handy kits of genuine Allen hex keys including 7/64- and 9/64-inch sizes for No. 6 and No. 8 '60 series cap-screws

announced by the Allen Mfg. Co., Hartford, Conn. The No. 664 Junior key kit has nine plated hex keys from 5/64- through 1/4-inch sizes that fit set-screws from No. 8 through 1/2 inch and '60 series cap-screws from No. 2 through 5/16 inch. The No. 666 "Handy-Pac" key kit has fifteen plated hex keys from 0.028 through 3/8 inch that fit set-screws from No. 0 through 3/4 inch and '60 series cap-screws from No. 0 through 1/2 inch. The keys in both kits are made from high-grade alloy

\$595 BURGMASTER Turret Drill Replaces \$8000 Chucker-Increases Production 400%

The Pelto Machine Co., Los Angeles, California, use a Burgmaster 6-Spindle Bench Model Turret Drill to perform five operations on Chrome-Nickel tool steel parts formerly machined on a single spindle Chucker. The change has stepped up production from 24 to 120 pieces per hour—an increase of 400%—and the \$595 Turret Drill plus a \$400 Standard Fixture replaces a machine representing an \$8,000 investment.

These are typical savings possible with the Burgmaster Bench Model Turret Drill for such operations as drilling, reaming, tapping, boring, counterboring, etc. This machine is much faster because each spindle is quickly power indexed and presented to the work at pre-selected speed and depth of cut, automatically shifting at top stroke of the sensitive feed handle. Individual spindle settings also assure fine finish, accuracy and long tool life.







BURGMASTER CORPORATION

Small Tool Division — Burg Tool Manufacturing Co., Inc. 15001 So. Figueroa Street, Box 311 Gardena, California Phone: FAculty 1-3510

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steel, heat-treated for added strength and toughness. Assortments are packed in plastic snapbutton envelopes.

Circle 614 on Readers' Service Card

Delrin Pipe Plugs

Lightweight pipe plugs which seal tightly without sealing compound and will not loosen under severe vibration introduced by Russell, Burdsall & Ward Bolt and Nut



Co., Port Chester, N. Y. Made of Du Pont Delrin, the plugs are usable with all types of organic fluids. Primary applications are in such products as compressors,

pumps, gas and water meters. caburetors and fuel pumps, power steering units, outboard motors, appliances, air condtioners, hydraulic and pneumatic cylinders, and vibration devices. Said to be lower in cost than presently available products, these Delrin plugs are available in 1/8-, 1/4-, 3/8-, and 1/2-inch sizes in square heads, and 1/8- and 1/4-inch sizes in hexagonal heads. The hollow design inside the plug increases sealing ability because as pressure increases, the plug threads are forced tighter against the mating threads of the hole. In pressure tests, the plugs have withstood from 3000 to 10,000 psi.

Circle 615 on Readers' Service Card

Ross Lightweight, In-Line Air Valves

One of a new series of lightweight, in-line air valves, said to improve response time an estimated 20 to 30 per cent above previous industry performance, announced by Ross Operating Valve Co., Detroit, Mich. This valve, named the Headline, is designed for minimum pressure drop and a long trouble-free life.



Poppets achieve full flow in short travel and have Buna N type resilient seals designed to automatically compensate for normal wear. The synthetic rubber-seal material was selected for its compatibility with industrial air-line lubricants. Both body and poppets are of anodized aluminum alloy. Zinc-

MOLINE NUMERICAL CONTRO (AS APPLIED TO MULTIPLE SPINOLE DRILLING)

Expertly Designed Machine Tools for-

Greater Production • Efficiency • Savings!

Model HD68 Tube Sheet Drilling Machine with Multi-Numetric Numerical Control for positioning of machine table in two directions and for selection of spindles. Infor-mation on punched tape permits automatic drilling of a complete hole pattern in a tube sheet without interrup-



Model HU111 Hydraulic Feed, Universal Joint-Type Drilling Machine with 24" x 50" drilling area and with forty-two 1-3/4" spindle drivers, each with two-speed and neutral adjustment. Thirty-six spindles in allp spindle plate, and power shifting fixture, handle drilling and reaming of three different engine cylinder



Model MR148 Three-way, three-spindle, horizontal boring machine with selective automatic feed cycle. Handles boring of cylinder and crank bore for 3 sizes of 1-cylinder blocks. Also bores for wet sleeves in 2- and 3-cylinder blocks.

HD13 straight line drilling machine with hydraulic table feed and 18 spindles each having 11/15° diameter drill capacity in mild steel. Spindle center distances are adjustable along the 6-foot machine rail.



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Representatives in principal cities



210

The Know-How Dimension in Milling Machines.. Special Machinery.. Automation Equipment thint A section of our assembly floor showing Automation-Type Ma-chines in process of manufacture. No. 2-20 Miller . . 20" table travel . . 42" x 12" table . . full automatic hydraulic feed. No. 1-14 Miller . . 14" table travel . . 32" x 9" table . . hydraulic table feed . . full automatic cycle. No. 3-36 Miller .. 36" table travel . . 64" x 16" table . . full automatic hydraulic feed.

.. makes the difference in cutting costs . . increasing production

Know-How, born of years of experience, abetted by sound and imaginative design and quality manufacturing standards... is the reason why many of our customers, representing a wide and diversified coverage of industry, come back to us again and again for answers to their production problems.

When you are considering procurement of machinery for your milling needs . . . or seeking the solution to other production problems...you may wish to consider a Kent-Owens Milling Machine or a Special Machine designed for a distinctive and individual application. Contract Machine Building (customer designed equipment) is another of our specialties.

Write or call...Kent-Owens will be pleased to quote your requirements. Kent-Owens Machine Company, Toledo 10, Ohio.

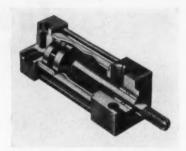
KENT-OWENS

Designers and Builders of Milling Machines and Special Machinery plated steel is used for poppet stems. The light weight of the moving parts assures rapid response. This valve may be airor solenoid-operated; is available in straightway, three-, or four-way types from 1/4- to 1 1/2-inch pipe sizes; handles air (or other fluid) pressures of 30 to 150 psi in the head and 5 to 150 psi in the body. Temperature service range is 40 to 175 degrees F., with ambient air range from 40 to 120 degrees F.

Circle 616 on Readers' Service Card

Midget Air Cylinder

Midget air cylinder for maximum pressure of 200 psi which is small enough to hold in the palm of the hand announced by the Hannifin Co., Des Plaines, Ill., a division of Parker-Hannifin Corporation. This cylinder is made in 3/4-, 1-, and 1 1/8-inch bore sizes with standard strokes up to 12 inches in double-acting models. Springretum models are also available. The square-head Series "S" Midget-Air is designed for small-force



cylinder applications which demand compact size and mounting versatility. Four basic mountings are inherent in the Midget-Air universal design, with optional clevis and flange attachments available upon request. The one-piece piston and stainless-steel piston-rod are permanently brazed together to prevent loosening during operation. O-ring seals assure dependable service at all working pressures. Special seals can be provided if working pressures exceed 165 degrees F.

Circle 617 on Readers' Service Card



Vickers Directional Control Valve

Improved performance and uprated capacity are featured in this new four-way solenoid-controlled, pilot-operated directional valve announced by Vickers Incorporated, Detroit, Mich., division of Sperry Rand Corporation. Although price and envelope size have remained virtually the same. the valve's nominal capacity of 30 gpm (gallons per minute) is 50 per cent greater than that of previous models. Another advantage, particularly with high-cycling machines, is the 300-per-cent reduction in valve-centering time. The valves are equipped with new Q-E-L (Quiet Extended Life) solenoids that are said to have four to five times the life of ordinary air-cooled solenoids.

Circle 618 on Readers' Service Card

FOR (R) QUALITY...

Our inspection projector magnifies cutting edges to eliminate the minute angular deflection that could cause you costly production losses just one of many inspections that account for Circle R quality.

CIRCLE R saws, slitters and combination center drills must submit to constant exhaustive inspection to work their way to you. They've got to prove they can ensure you correct cutting angles, long service, and minimal downtime.

CHICAGO

old Subertion & Co.
CLEVELAND

oduction Tool Co.
DAYTON

B. Earth Company

DETROIT

NEW MYDE PA

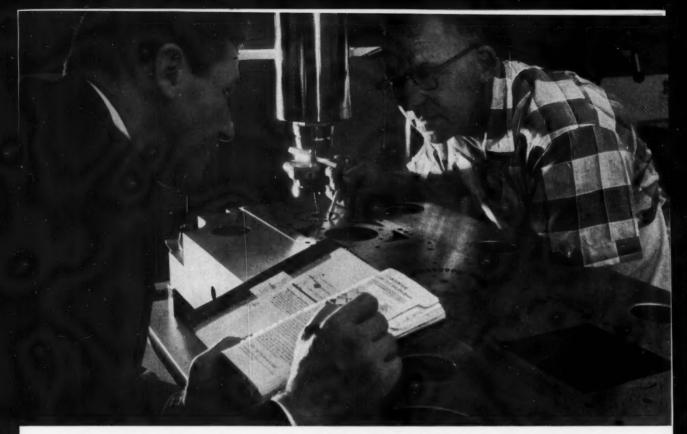
PHODRIX
Bi-Euganio Taol Conto
PITTSBURGH
Roiph Esponito & Co.
PROVIDENCE
Frad J. Michilan
BOCHESTER
Jomes G. Herno

CIRCULAR TOOL CO., INC.

PROVIDENCE 5, RHODE ISLAND
Specialists in Circular Cutting Tools Since 1923

METAL SLITTING SAWS - COPPER SLITTING SAWS - SCREW SLOTTING SAWS - COMMUTATOR SLOTTING SAWS - JEWELERS' SLOTTING SAWS - COT OFF SAWS - CIRCULAR





But what about the RELIABILITY FACTOR in the selection

of tool and die steels? More output per grind . . . steady, high volume production at low cost . . . these are tooling benefits you look for on the job. They stem from the basic quality built into these three Carpenter MEL-TROL® Air-Hardening Tool and Die Steels . . . VEGA-FM, No. 484-FM, and No. 610-FM. Yet, good toolmen know that dependable performance hinges on still another factor: a sound, reliable way to select the



right steel for each job. Here's exactly why Carpenter's Matched Set of Air-Hardening Tool and Die Steels gives you a tooling plus: You select quickly and accurately from just three grades to get the exact properties you need for almost any air-hardening application—maximum wear resistance (No. 610), maximum toughness (Vega), or a good combination of hardness and toughness in No. 484.

What's more . . . you know in advance that the steel you select will "deliver the goods". And realize, too, that these three steels are carried in ample stocks for quick delivery from your nearest Carpenter SERVICE-CENTER.

Carpenter steel

you can do it consistently better with Carpenter Tool and Die Steels



The Carpenter Steel Company, Main Office and Mills, Reading, Pa. Alloy Tube Division, Union, N. J. Webb Wire Division, New Brunswick, N. J. Carpenter Steel of New England, Inc., Bridgeport, Conn.

to cut your metal finishing costs-



features "building block" components arranged for completely automatic finishing cycles

An automatic part load/unload and turnover mechanism is the latest addition to Osborn's Rotary Index metal finishing units. This feature eliminates the need for production machine operators—and means regulated work flow plus higher production rates.

Most significant feature is the use of a *standard* index table and *standard* finishing heads easily tailored for efficient, economical *automated finishing* operations.

Other advanced design and construction features make these Osborn Metal Finishing Machines worth your immediate investigation.

Your Osborn field specialist has latest application data on a wide range of cost-saving finishing methods. An Osborn Analysis—made in your plant now at no cost or obligation—is the first step to pinpoint savings in your operations. Write or call The Osborn Manufacturing Company, Dept. D-62, Cleveland 14, Ohio. Phone ENdicott 1-1900.



Metal Finishing Machines . . . and Finishing Methods
Power, Paint and Maintenance Brushes • Foundry Production Machinery



Midget Torque Actuator

Rotac midget torque actuator now available for light applications announced by the Ex-Cell-O Corporation, Greenville, Ohio. Having a body only 2 inches square and 2 inches long, this compact unit is operated by hydraulic or pneumatic pressure to produce reciprocating rotary movement. The single-vane model produces rotation in a maximum arc of 270 degrees, while movement of the double-vane model is restricted to 90 degrees, but power is more than doubled. These midget actuators are being applied in instruments, computers, calculating machines, switches, and valve controls.

Circle 619 on Readers' Service Card



Retainer-Ring Pliers

New size "convertible" field pliers (lower right) which may be used for a wide range of internal and external retaining rings of type shown in upper left developed by Waldes Kohinoor, Inc., Long Island City, N. Y. Known as the Truarc No. 12 pliers, the tool is designed to be used in two ways: to compress internal type rings for insertion into a bore or housing, or to expand external type rings for assembly over a shaft. A simple adjustment of the pivot-pin sets the pliers for either job.

Circle 638 on Readers' Service Card

NEW TOOL STEEL SERVICE

helps you estimate costs more accurately!



Estimating tooling costs, especially on new jobs.



becomes more accurate and profitable with Crucible's new Tool Steel Service.



This service enables you to use fewer grades of tool steels...



which you get to know inside-out! So, you can more accurately predict



machining and bench time, and response to heat treating.



And because you're completely familiar with all the basic grades you use...



you can pin-point your estimates and your actual costs.

For the complete story on all the cost reductions available with this service, call in a CRUCIBLE Service Engineer.

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STEEL COMPANY OF AMERICA

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News of the industry

California

SOLAR AIRCRAFT Co., a subsidiary of International Harvester Co., San Diego, Calif., has elected Paul A. Pitt vice-president of engineering. In his new position, Mr. Pitt heads Solar's engineering and research activities. At the same time, Sumner Alpert was named manager of a new division—which includes Solar's aerospace, ground support, and industrial products—with responsibility for sales and project engineering in these areas.

NORMAN SILVERBERG has been appointed sales manager of the West Coast division of Arwood Corporation, Los Angeles, Calif. Mr. Silverberg will be in charge of all sales activities for the Los Angeles plant, and for the company's Mercast Division at La Verne, Calif. In his new capacity, he will be located at the Arwood plant at 3037 S. Vail Ave., Los Angeles 22.

RUSSELL, BURDSALL & WARD BOLT AND NUT Co., Port Chester, N. Y., has opened a new direct factory warehouse to service San Francisco Bay area users of industrial fasteners. Located at 1700 Bancroft Ave. (5600 N. Third St.), San Francisco, Calif., the new warehouse building will house the company's regional sales office—under John Boyd and ROBERT BLANCHARD.

DAVID H. BROWN has been appointed general manager of the BENDIX-PACIFIC DIVISION of BENDIX CORPORATION, North Hollywood, Calif. Mr. Brown, assistant general manager of the division since 1955, succeeds R. C. Fuller, who remains group executive in charge of all Bendix-Pacific and Bendix computer division operations.

THOMAS R. KLECAK has been named West Coast regional manager—industrial distribution for PRATT & WHITNEY Co., INC., West Hartford, Conn. Mr. Klecak will be headquartered in the Los Angeles, Calif., area and work with distributors on the West Coast.

Illinois

A. S. BLODGET, JR., has been appointed regional vice-president of the midwestern area by AIR REDUCTION SALES Co., New York City. In



A. S. Blodget, Jr., newly appointed vice-president-midwestern region, Air Reduction Sales Co.

his new position, Mr. Blodget is responsible for the sale and distribution of all Airco products marketed in the midwest region, which includes the districts of Chicago, Milwaukee, Minneapolis, Bettendorf (Iowa), Kansas City, St. Louis, and Detroit. Regional headquarters are located in Chicago.

SNYDER CORPORATION, Detroit, Mich., announced the appointment of Neff, Kohlbusch & Bissell, Inc., as midwestern sales representative. The latter company, with main offices at 5700 W. North Ave., Chicago 39, Ill., will handle sales of Snyder special machine tools and automated machinery in Illinois, Iowa, Indiana, Minnesota, and Wisconsin.

FAFNIR BEARING Co., New Britain, Conn., has announced the assignment of RICHARD M. RIVAL and RUSSELL F. HJERPE to the company's field sales organization. Mr. Rival joins the Cincinnati, Ohio,

branch office as a sales representative. Mr. Hjerpe is now assigned to the Chicago, Ill., branch as a sales engineer.

Verson Allsteel Press Co., Chicago, Ill., has announced the appointment of George Petruck as sales representative for the Chicago area.

JACK T. LE BEAU has been elected vice-president in charge of the Abrasives Division by BESLY-WELLES CORPORATION, Chicago and South

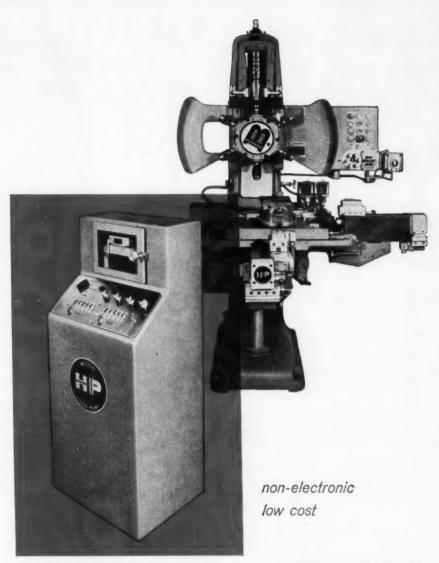


Jack T. Le Beau, newly elected vice-president — Abrasives Division, Besly-Welles Corporation

Beloit, Ill. Mr. Le Beau, who has been with Besly-Welles for twenty-four years, replaces NORMAN C. MINEHART, who retired after thirty-eight years with the firm.

VICTOR C. KRANZ has been appointed sales engineer in the Chicago area for the CLEARING division of U. S. INDUSTRIES, INC., Chicago, Ill.

JOHN G. MORGAN has been appointed manufacturing manager of HUPP AVIATION DIVISION, HUPP CORPORATION, Chicago, Ill. Mr. Morgan joined the division in 1951 as product design engineer and sub-



HYDRA-POINT

numerical control simplified

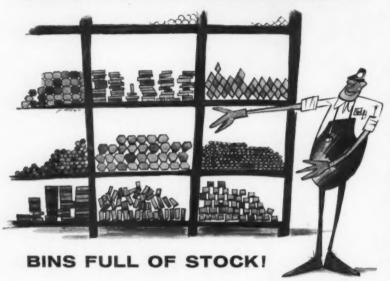
The Moog Hydra-Point is a point-to-point numerical control system which achieves highly accurate table positions by a simple hydraulic device which does not involve the use of electronics. Proven fluid power design techniques result in reliable numerical control at reduced cost and maintenance. The standard Moog system includes tape-reader, hydraulic power supply, control console and table positioning actuators.

MOOGHE INDUSTRIAL DIVISION

EAST AURORA. NEW YORK



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Each W-L warehouse maintains complete stocks of alloy steels, including standard AISI and SAE steels, and our own HY-TEN steels, which offer advanced metallurgical features at competitive prices.

With Wheelock, Lovejoy, you merely order the steel you need—as you need it—in specified sizes, shapes, grades and treatments.

For service that's complete, and completely satisfactory, call the W-L branch nearest you.

W-L STEEL SERVICE CENTERS — Cambridge • Cleveland Chicago • Hillside, N. J. • Detroit • Buffalo • Cincinnati AGENTS — Southern Engineering Company, Charlotte, N. C.; Sanderson - Newbould, Ltd., Montreal & Toronto

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LOVEJOY
& COMPANY, INC.
138 Sidney St., Cambridge 39, Mass.

STRUCE CENTER INSTITUTE



John G. Morgan, manufacturing manager of Hupp Aviation Division, Hupp Corporation

sequently became project engineer, quality-control manager, chief tool designer, and chief manufacturing engineer.

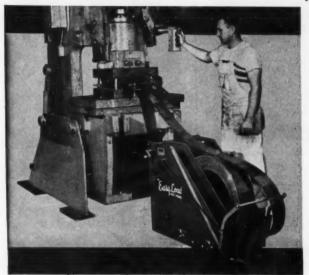
Michigan and Minnesota

FORD MOTOR Co., Metal Stamping Division, Dearborn, Mich., has announced the appointment of K. N. KRECKE as manufacturing manager for the company's stamping plants. In the newly created position, Mr. Krecke will direct operations of the Metal Stamping Division's four manufacturing plants in Dearborn; Buffalo, N. Y.; Chicago, Ill.; and Cleveland, Ohio; and the Dearborn tool and die plant. Appointment of CHRISTOPHER E. BOWLES as manager of the Dearborn engine plant, succeeding Mr. Krecke, and of WALTER H. JOHNSON as production manager of the plant was also announced. DONALD PICKLES has been made manufacturing and production engineering manager for the division. He will direct activities of a component in which the former production engineering, manufacturing engineering, material handling, and work standards departments are consolidated. George Bernard succeeds Mr. Pickles as manager of the material forming and assembly department of the manufacturing staff.

DR. ERWIN M. KOERITZ WAS appointed manager of manufacturing for Metallurgical Products Department, General Electric Co., Detroit, Mich. Since 1956 Dr. Koeritz has been manager of manufacturing engineering in the firm's Silicone Products Department, Waterford, N. Y. From 1954 to 1956 he was supervisor of process engineering

get HERUY DUTY performance with

ROWE 2000 SERIES "Easy Load" COIL CRADLES



MODEL	MAXIMUM WEIGHT CAPACITY	MAXIMUM WIDTH CAPACITY	MAXIMUM O.D. CAPACITY	FLOOR SPACE REQUIRED
2010	2000#	10"	40"	16" x 32"
2015	2000#	15"	40"	21" x 32"
2020	2000#	20"	40"	26" x 32"
2024	2000#	24"	40"	30" x 32"

Engineered and built to exacting specifications, ROWE 2000 Series "Easy Load" Cradles will perform perfectly under the most rugged operating conditions. The \(\frac{\psi_0}{-}\) inch thick steel frame will take a tremendous beating. The precision machined and threaded guide bars are alloy tough and heavy duty bearings support the feed rolls under repeated coil contact. The dependable chain drive with flame hardened sprockets feeds most materials accurately and without slipping.

Cradles in the 2000 Series can reduce your set up time because they can be moved easily and all models are equipped with two movable side guides which quickly position the coil for feeding. Four sturdy, fully-powered rolls feed coils weighing up to 2,000 pounds with positive, direct control. An easily adjustable, built-in time delay allows the press ram to clear before the next coil segment is fed — eliminating crimping and buckling. The actuator arm maintains a constant size slack loop, following the contour of any coil and operating in any position.

contour of any coil and operating in any position. Investigate the complete ROWE line soon. Other equipment includes "Easy Load" Coil Cradles to 20,000 pound capacity, Straightening Machines, Straightening and Feeding Machines, Cabinet Feeds, Roll Feeds, Coil Catchers and Storage Ramps, Combination Cradle and Straightening Machine Units, Coil Buggies, Reels, Conveyors, Stackers and Complete Sheeting Lines.

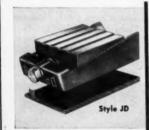
ROWE MACHINERY AND MANUFACTURING CO.INC. IT REGAL ROW DALLAS. TEXAS

For more data circle Item 219A





DEPENDABLE MACHINE SUPPORT!





With

EMPCO

LEVELING JACKS

For better machine performance set your machines level and keep them level! That's the key to increased production with less maintenance! EMPCO Leveling Jacks provide a solid, adjustable support for machine tools, large surface plates, tool room, and production equipment of all types. Easily installed and located, EMPCO Jacks keep your equipment level and

stable—keep maintenance at a minimum.

VI-SORB Mounting Pads, optional with EMPCO Jacks, control vibration from within the machine itself and reduce transmitted vibrations. Available in six styles and 25 models there's a EMPCO Jack and VI-SORB Mounting Pad for your every machine leveling requirement!

WRITE TODAY FOR ILLUSTRATED BULLETIN AND PRICES!



THE ENTERPRISE MACHINE PARTS CORPORATION
2727 JEROME AVENUE . DETROIT 12, MICHIGAN

For more data circle Item 219D

THINK SPEED!

...and you'll think Beatty!



BEATTY GUILLOTINE BEAM PUNCH

"We have estimated our savings at 75 percent with our new No. 9 Guillotine Beam Punch and Spacing Table," says one Beatty user. The Beatty No. 9 Guillotine Beam Punch punches flanges and webs of I-beams from 6 to 30 inches. Large die space; clear working space. 200-ton capacity.



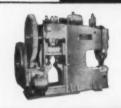
BEATTY SPACING TABLE

Spacing of holes and slots in beams, channels, and plates is precise and automatic with the Beatty Spacing Table. One passthrough completes the job of punching a flatence of the precise of the precise of the and one helper are needed to accomplish the task... in a matter of seconds!



BEATTY GUILLOTINE BEAM WEB PUNCH

When the objective is to reduce set-up time, the answer may very well be the Beatty Guillotine Beam Web Punch. Offering 200-ton capacity, the Beam Web Punch is arranged for web punching with six sets of gagged tools, decreasing time required for set-up as beam sizes and dimensions change.



NO. 7 DETAIL BEAM PUNCH

is the machine which does the work of THREE, punching I-beams in just three passes instead of the usual five... simultaneously eliminating the end-for-end turning of beams. The Beatty No. 7 Detail Beam Punch is of 100-ton capacity, capable of punching up to 1½ inch hole through 1-inch mild steel.

Job-engineered to speed work flow and always dependable in performance, the Beatty line is equipped to provide savings of time and cost . . . in a host of metalworking areas.

So, if you've been thinking in terms of greater speed and lower costs (and who hasn't?), now is the time to start speaking the Beatty language.

Yours for the asking: Complete literature on the products of Beatty and Beatty Quickwork is available on request. Why not write . . . right now?



MACHINE & MANUFACTURING COMPANY 941 150th St., Hammond, Indiana



Dr. Erwin M. Koeritz, newly appointed manager of manufacturing-Metallurgical Products Department, General Electric Co.

there. He joined that department in 1952 in process-development engineering work.

CLEVELAND PUNCH & SHEAR WORKS Co., Cleveland, Ohio, has appointed MOTCH & MERRYWEATHER MACHINERY Co., Detroit, Mich., to handle the sales of Cleveland's line of mechanical power presses for the metal-stamping industry. The Motch & Merryweather sales and service facilities in Cleveland; Detroit; Pittsburgh, Pa.; and Cincinnati, Ohio, will be augmented by Cleveland Punch & Shear's own staff of engineers. Ioseph F. Lacchia. Cleveland's factory representative in Michigan, will have his office in the Motch & Merryweather headquarters at 23520 Woodward Ave. in Detroit.

DETROIT TOOLING ASSOCIATION (formerly known as the AUTOMOTIVE TOOL & DIE MANUFACTURERS ASSOCIATION), Detroit, Mich., has elected the following officers: president—GEORGE TANN, vice-president of Congress Tool & Die Division, TANN CORPORATION; vice-president—HOWARD N. MAYNARD, president of SNYDER CORPORATION; and treasurer—WENDELL G. MOUW, president of ROYAL OAK TOOL & MACHINE CO.

Parker-Hannifin Corporation, Cleveland, Ohio, announces the purchase of two Michigan concerns, the Span Brass Mfg. Co. of Otsego and the Spanco Brass Sales Co. of Allegan. The two companies will be operated as the Spanco Brass Co. Division of Parker-Hannifin Corporation. Floyd Burge, formerly president, will become general manager of the new division.

LEO W. SHEEHAN has been made district sales manager in the Detroit, Mich., area for the BULLARD Co., Bridgeport, Conn. Mr. Sheehan's entire career with the company has been in the Detroit area, as assistant district sales manager since January, 1950, and prior to that, as a sales engineer since September, 1947.

Walter B. Connolly has been appointed general plants manager for Chrysler Corporation's stamping group, Detroit, Mich. In his new position, Mr. Connolly will be responsible for the general operations of the plants in the group. He will also direct group plant managers in the installation of all programs and policies.

Wesson Co., Ferndale, Mich., announces the appointment of A. V. Durovich and M. M. Goulding to the company's eastern district office. Mr. Durovich will assist industry on the more effective use of standard and special boring, milling, and turning tools in northern New Jersey. Mr. Goulding will do the same in metropolitan New York.

E. W. Bliss Co. has announced the relocation of its press-sales head-quarters from the general office in Canton, Ohio, to the company's plant at Hastings, Mich. This move was made as a part of the company's program of decentralization.

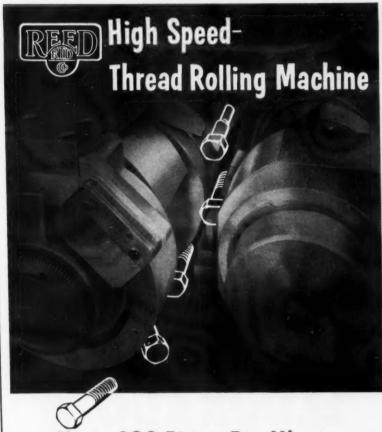
RICHARD MILLER has been appointed manufacturing manager at BUHR MACHINE TOOL Co., Ann Arbor, Mich. Mr. Miller's background includes executive and manufacturing positions in the machine tool and automotive industries.

The appointment of Douglas L. Heisler as director of purchasing has been announced by Vickers Incorporated, division of Sperry Rand Corporation, Detroit, Mich.

MICROBORE DIVISION OF DEVLIEG MACHINE Co., Royal Oak, Mich., has appointed the JOHN C. EIDE Co., Minneapolis, Minn., its exclusive sales representative to handle the entire Microbore line of precision boring, turning, and facing tools. John C. Eide's sales area includes the entire state of Minnesota and northwestern counties of Wisconsin.

New England

NORTON Co., Worcester, Mass., has made Winton A. Vagedes, Cleveland, Ohio, district manager of



Up to 200 Pieces Per Minute

with cylindrical single revolution dies

The Reed B910 Cylindrical Die Thread Rolling Machine is a rugged general purpose two-die type machine for high speed production. This machine is adaptable to a wide range of work using single revolution dies where the parts are rolled within one revolution of the dies. Diameters

 $\frac{3}{16}$ " through 1" and thread lengths up to $6\frac{1}{2}$ " long may be rolled.



The machine is simple to set up and convenient to operate. Both semi- and completely automatic work-handling equipment is available to take full advantage of the high production capabilities of the machine.

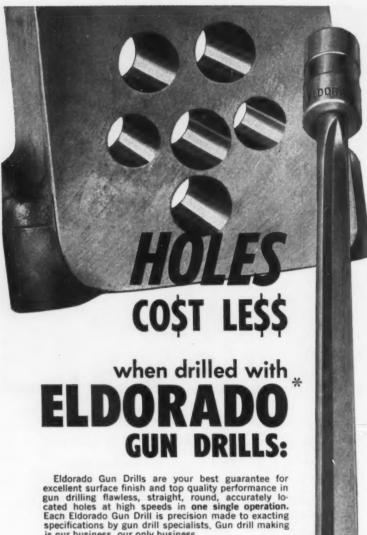
Write for Machine Bulletin B-910-1



REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment HOLDEN, MASSACHUSETTS, U. S. A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Denvoit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Taronto



is our business, our only business.

With hole after hole, in drilling steel, iron, aluminum or other alloys, at speeds and feeds impossible with other types of drills, Eldorado drills cut costs in time, labor, tools, materials and maintenance.



There's an Eldorado Gun Drill for your job! Immediate delivery from factory stock. We invite you to talk over your 'hole' problem with us at no obligation.

Send for NEW LITERATURE on Gun Drills and Gun Reamers.

ORDER STOCK SIZES FOR IMMEDIATE SHIPMENT. TO SPECIFICATIONS, ON NORMAL DELIVERY.

YOUR SPECIFICATIONS:	AVAILABLE FI	ROM STOCK:
.1250" to 2" dia.	1/8" to 1/2" dia. in 64ths	1/2" to 3/4" dia. in 32nds
" to 120" with dia. limits	10", 16", 22", 36"	16", 22", 36"
Std. or to fit you need	.750" dia. x 23/4" long	1" dia. x 23/4" long
Carbide	Carbide	Carbide
	.1250" to 2" dia. 4" to 120" with dia. limits Std. or to fit you need	.1250" to 2" dia.

Specializing 100% in Gun Drills and Related Tools.



ELDORADO TOOL & mfg. corp. 348 BOSTON POST ROAD . MILFORD, CONN. the Abrasive Division. He succeeds CHEEVER H. ELY, who has been selected for a special assignment in the New England district. JACK M. Esten, formerly abrasive engineer in Philadelphia, Pa., has been named to succeed Mr. Vagedes in the New Jersey area. KARL E. KROG-STAD, formerly a field engineer in Philadelphia, will become abrasive engineer in that area.

UNITED-GREENFIELD CORPORA-TION, Greenfield, Mass., has announced the election of EDWIN W. ZIPSE as president and chief executive officer and JACK C. MALUGEN as executive vice-president. Mr. Zipse,



Edwin W. Zipse, president and chief executive officer, United-Greenfield Corporation

who succeeds Konstantin Kron-WALL, is in his thirty-fifth year with the company. He became executive vice-president in 1954, and has been a director since 1951 and a member of the executive committee since 1958. Mr. Malugen, who started with the company in 1942 as a salesman for the CHICAGO-LATROBE DIvision, became a director of the parent company in 1958 and a member of the executive committee in

RICHARD A. MIERKE has been appointed Atlantic district sales representative for Carboloy cementedcarbide products by Metallurgical Products Department, GENERAL ELECTRIC Co., Detroit, Mich. Mr. Mierke will assume sales responsibility on the eastern seaboard, operating out of Holden, Mass.

HEALD MACHINE Co., a subsidiary of Cincinnati Milling Machine Co., Worcester, Mass., has appointed new branch managers in the Chicago, Ill., and New England sales territories. Joseph W. Whitaker, Jr., was named branch manager of the Chicago office, succeeding Oliver A. Johnson, who has retired. Walter R. Szarek was promoted to branch manager of the New England area territory, succeeding F. D. Gibbs, also retired.

LINWOOD A. STEDMAN has been named manager of the New England district, with offices in Springfield, Mass., by PANGBORN CORPORATION, Hagerstown, Md. Formerly sales engineer in Springfield, he succeeds John H. Connolly, who retired recently after more than twenty-two years as district manager.

In view of the resignation of Edward M. Dowd as executive vice-president, Lapointe Machine Tool. Co., Hudson, Mass., has appointed George J. Bacnall as vice-president in charge of engineering and manufacturing, and William L. Gibbons as factory manager.



Keith T. Middleton, executive vicepresident, Fafnir Bearing Co.

Fafnir Bearing Co., New Britain, Conn., has elected Keith T. Middleton executive vice-president. Also elected were Beecher N. Claflin as an assistant secretary and Edwin A. Ingrresen as an assistant treasurer. Mr. Middleton was formerly administrative vice-president and secretary. He joined Fafnir in 1952 as assistant secretary and counsel, after serving as the company's labor relations counsel since 1943. Mr. Claflin came to Fafnir in May, 1959, and was appointed manager of accounting last January.

PAUL ERIK DILLBERG has been appointed sales manager for the

To get the most out of your barrel finishing

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE . OVER 250 SERVICE MEN . OVER 160 MATERIALS



"Media-matched" Oakite compounds offer extra barrel-finishing economies

Any experienced barrel-operator can tell you that best results come from the right media and compound "mix"...where media and work are matched; and the compound matched not only to the work but also to the media.

Some signs of a good match: clean and efficient media enough lubrication to assure a smooth finish; and faster cutting down, deburring and burnishing.

How to avoid a mismatch? That's where Oakite service can help you. Combine the Oakite man's experience with the tremendous variety of acid, solvent, and abrasive Oakite compounds available, and you're sure to be right.

In the complete line, there are compounds for fast cutting... finer finishes...tight tolerances...for steel, brass, aluminum, zinc, lead and various alloys...for hard water or soft. Ask Oakite which is the *right* one to help you get the most from your barrel. Bulletin F-9339 tells more. Write Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite



SKINNER-HORTON CHUCK DIVISION OF SKINNER PRECISION INDUSTRIES, INC., New Britain, Conn. Mr. Dillberg succeeds Kenneth H. Walther who, after forty years with the company, will continue as secretary and sales consultant. Mr. Dillberg has been associated with the chuck industry for over twenty years in various engineering, production, and sales activities.

FENN MFG. Co., Newington, Conn., has announced plans for the construction of a large addition to the firm's main plant. It will increase the manufacturing area by one-third. A large portion of the addition, which will be ready for occupancy in June, will be used for enlarging the assembly area of its heavy-machinery division.

John E. Eckert has been appointed vice-president in charge of engineering by the Waterbury Farrel Foundry & Machine Co., division of Textron Inc., Waterbury, Conn, He has had substantial engineering experience with the Armzen Co., which in 1956 was merged with the Waterbury Farrel



John E. Eckert, vice-president in charge of engineering, Waterbury Farrel Foundry & Machine Co.

Foundry & Machine Co. At that time, Mr. Eckert became the chief engineer of the Consolidated Rolling Mill Division of Waterbury Farrel.

WALLACE BARNES has been elected executive vice-president of ASSOCIATED SPRING CORPORATION, Bristol, Conn. He retains his position as secretary of the corporation. In order to assume his new duties on a full-time basis, he will withdraw as a partner in the Bristol law firm of BEACH, CALDER & BARNES.

JOHN V. QUINN has joined UNITED AIRCRAFT CORPORATION'S NORDEN DIVISION, Stamford, Conn., as factory superintendent. He is located at the division's Milford department until the manufacturing area is set up in the new plant in Norwalk.

New York and New Jersey

The appointment of H. C. Webb as district sales manager of the central area was announced by HAYNES STELLITE Co., a division of UNION CARBIDE CORPORATION, New York City. Mr. Webb, who succeeds F. P. SHEPHARD, joined the company as a sales engineer in 1953.

KEN C. TUCKER, formerly manager of the food industries division of OAKITE PRODUCTS, INC., New York City, has been named assistant sales manager of the firm. One of the major responsibilities in his new post will be the servicing of national accounts.

Angelo P. Fasciano has been appointed field sales supervisor for the New York-Long Island district by Vascoloy-Ramet Corporation,



Here's an example of how Seneca Falls Model Q Automatic Lathes combine the best and fastest turning methods. In the set-up illustrated above, three tools on the rear carriage rough turn the stem pinion while the first overhead tracer tool semi-finish turns on the first pass...then indexes, and a second tool finish turns on the final pass.

One loading! One completely automatic cycle! Write for Bulletin No. Q-59.

model tracer lathe features

- "Dial Your Set-up System" simplifies changeover.
- Multiple tools rough and tracer tools finish turn in one automatic cycle.
- Mechanical feed to all carriages.
- · Templates clear of chip area.
- · Easy to load and unload.
- Straight line diameter adjustment for tracer tools.
- Four speed headstock available with automatic speed change.
- Feed rate can change during cutting cycle.



224

DO tell us your troubles. If turning, centering or automation are involved, most likely we can do more than sympathize

SENECA FALLS, MACHINE CO.

Waukegan, Ill. Mr. Fasciano will be headquartered in Rosedale, N. Y., at 259-28, 148th Road.

BENGT E. KELLSTRAND has been made field sales representative in the upper New York State area for ALLEN MFG. Co., Hartford, Conn. He will make his headquarters in Cazenovia, N. Y.

The appointment of Edward V. Barry as a sales representative for the machinery division has been announced by Joseph T. Ryerson & Son., Inc., Jersey City, N. J. With the firm for the past five years, Mr. Barry has been engaged in sales work for most of this period.

HAROLD J. BILLINGTON, JR., has been named sales manager of the H. A. WILSON DIVISION OF ENCELHARD INDUSTRIES, INC., Union, N. J. With Engelhard for the past six years, Mr. Billington is now in charge of the over-all sales activities of the division.

Ohio

The following executive positions have been announced by the SHEFFIELD CORPORATION, a subsidiary of the BENDIX CORPORATION, Dayton, Ohio. JACK T. WELCH, vice-president—sales, is transferring to Bendix International, New York, where he will become director of industrial marketing for the division. WILLIAM I. WILT, vice-president—advertising



William I. Wilt, vice-presidentmarketing, Sheffield Corporation

and promotion, becomes vice-president—marketing and will direct Sheffield's domestic and export sales, as well as continuing the direction of advertising and publicity. RICHARD CHANEY and EDGAR HAKANSON have been named marketing managers to assist Mr, Wilt. Mr. Chaney will con-

centrate on the export market and specific large-volume products, and Mr. Hakanson will handle large capital-equipment marketing projects. Walter Burkart has been promoted from assistant manager to the position of manager of the Machine Tool Division.

New Britain Machine Co., New Britain, Conn., announces plans to relocate its Indiana-Kentucky-Ohio sales office (New Britain-Gridley Machine Division) from Cincinnati to 401 Leo St., P. O. Box 65, Dayton 4, Ohio. The new quarters will

be situated in the plant of a subsidiary of the New Britain Machine Co.—Koehler Aircraft Products Co. The three sales engineers connected with this office are Stanley Brown, manager; Ira Baldwin; and Walter Gerould.

Ohio Forge & Machine Corporation, Cleveland, Ohio, has purchased Cleveland Punch & Shear Works Co., located in the same city. E. P. Prescott, chairman of the board at Ohio Forge, has been elected chairman at Cleveland Punch & Shear Works. Charles E.



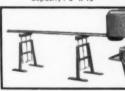
Model B (Wet or Dry)
Dependable. Economical. Easily
handles 5" rounds, 10" flats.

Johnson

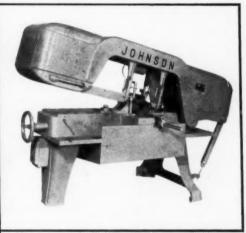
Speaks for itself in ANY SHOP!



Model M (Mobile).
Rolls to the job, inside or out.
Capacity: 5" x 10"



Johnson Adjustable Stock Stand. Provides rigid, safe work support.



The Big Model J. (Wet or Dry) Fast Tough. Accurate. Capacity: 10" rounds, 18" flats

The big, dependable Johnson delivers more saw for less money. It easily and accurately handles anything in your stock pile: rods, angles, tubes, heavy rounds, irregular shapes, and flats.

Whatever model fits your production requirements, you'll find Johnson versatility will boost your production and lower your metal cutting costs. Today, the Johnson saw speaks for itself in thousands of progressive shops . . . wby not yours?



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1016 BARNES STREET, ALBION, MICHIGAN

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HASTINGS DISTRIBUTORS
1605 Solano Avenue
Reckeley Calif

THAYER, president of Ohio Forge, will hold the same office at Cleveland Punch & Shear. CHARLES E. HUDDLESTON, executive vice-president, and GERARD BASTIAN, treasurer, will continue in those offices.

CLEARING, a division of U. S. In-DUSTRIES, INC., Chicago, Ill., has announced plans to manufacture its complete lathe line in its Hamilton, Ohio, facilities. Previously, this operation was carried on at Clearing's Chicago plant. In addition to the manufacture of lathes, all other selling services, including engineering, sales, and advertising, will be located at the Hamilton plant.

CINCINNATI MILLING PRODUCTS DIVISION, CINCINNATI MILLING MA-CHINE Co., Cincinnati, Ohio, has announced the appointment of George E. PARKER as assistant sales manager. Succeeding Mr. Parker as Chicago, Ill., district sales manager is CHARLES E. REICHEL, who has served as sales representative in the division's Chicago office since 1949.

CARL H. SMITH has been named manager of sales engineering for the E. W. BLISS Co., Canton, Ohio, division. In his new position, he will be responsible for sales engineering as well as estimating, contact, and customer relations for the divsion.

LEROY E. BONNETTE has been named director of engineering for DENISON ENGINEERING DIVISION, AMERICAN BRAKE SHOE Co., Columbus, Ohio. Mr. Bonnette joined Denison in 1942. In 1955 he was made chief engineer.

Pennsylvania

FIRTH STERLING INC., Pittsburgh, Pa., announces the following appointments to its sales organization: W. TRAVERS KNAPP has been made carbide division sales representative in the mideastern district, with headquarters at Mountainside, N. J. WIL-LIAM N. PITCHFORD, JR., is assigned to the company's Detroit, Mich., district sales staff. He will handle the sales of steel division products in that area. JOHN H. PLASKET, also assigned to Firth Sterling's Detroit district, will represent the firm's carbide division. KENNETH R. VOLK has been named a steel division representative in the Pittsburgh, Pa., district. He will cover the Rome, Syracuse, Elmira, and Watertown areas of upper New York state.

WALTER T. HASWELL, JR., has been named vice-president in charge of production for LATROBE STEEL Co., Latrobe, Pa. Joining the company in 1945 as a mill metallurgist,



Walter T. Haswell, Jr., vice-president in charge of production, Latrobe Steel Co.

Mr. Haswell served as assistant superintendent of the cold-finishing department, assistant production man-

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8-STATION PRODUCTION MACHINING 11/2" BAR AND COLLET WORK CHUCKING SINGLE POINT THREADING

This is an all new 1½" bar capacity ram type turret lathe with power feeds to all 8 working stations . . . that in addition to bar and collet work also has the versatility to do chucking, and when needed, single point threading. Powered by a 5 h.p., two-speed, geared motor, the new Sheldon 3 R turret lathe provides 16 spindle speeds, 60 different feeds to the carriage and cross-slide, and 180 different feeds to the tark turret. the ram turret.

The turret itself is ruggedly built and accurately machined to provide close tolerance indexing. And for complete ease of operation, it is put under power by simply pressing a push button on the control panel.

This new 3 R Sheldon is completely equipped with two-speed motor and electrical controls, coolant system and splash guards, LO spindle nose, large satin chrome dials and hardened bed ways. It also provides an additional cost saving feature—each turret face is drilled and tapped for your standard flange type tooling as well as being bored for your standard 1½" shank type tooling.

For versatile, accurate machining in either long or short runs, the new Sheldon 3 R provides the answer to low investment cost with high profit

operation.



ager of the hot mills department, and superintendent of the cold-finishing department, before becoming works manager in 1955.

MARQUIS P. ORR has been appointed general sales manager of the MACKINTOSH-HEMPHILL DIVISION of E. W. Bliss Co., Pittsburgh, Pa. In his new capacity, Mr. Orr will be responsible for sales of cast rolling-mill rolls, roll-turning lathes, rotary tubestraightening machines, cinder pots, and castings which are produced at the division's two plants at Midland and Pittsburgh, Pa.

FREDERICK H. NORTON was named regional sales manager for the east-central sales area of Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. The region for which Mr. Norton will be manager consists of Ohio, West Virginia, western Pennsylvania, and eastern New York. The regional sales office is located at 1098 Union Trust Bldg., Pittsburgh, Pa.

The appointment of James A. Graham as general manager of the Bearings Co. of America Division, Lancaster, Pa., has been announced by Federal-Mogul-Bower Bearings, Inc., Detroit, Mich. Mr. Graham, who succeeds J. A. McCarthy, is the former manager of two SKF manufacturing plants in Philadelphia.

SKF INDUSTRIES, INC., Philadelphia, Pa., has acquired the assets of NICE BALL BEARING Co. (located in the same city), a division of CHANNING CORPORATION. Nice Ball Bearing Co. will continue to operate as an entirely independent organization, maintaining present personnel and policies.

CHARLES A. GRIM has been appointed product sales manager of the Cold-Rolled Specialties Division, CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa. He was formerly assistant product sales manager in the division.

Texas

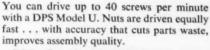
Texas Industrial Products Co., San Antonio, Tex., has been appointed an authorized distributor of Carboloy cutting tools by the Metallurgical Products Department, General Electric Co., Detroit, Mich. Located at 717 S. Alamo St., San Antonio 5, Tex., the firm will serve the San Angelo, Austin, San Antonio, Corpus Christi, and Brownsville areas.



DPS model U power screwdriving machines

- Maintain constant driving torque with new positive control clutch
- Dependable motorized hopper drive with safety clutch protects motor and gears in the event of jamming
- Release screw by body or head with new feed track and escapement mechanism

Write today for DPS Model U Bulletin



DPS offers the Model U in two types: pedestal, and self-contained driving head. Both require minimum space and are readily adaptable to your work flow. Feed track and escapement mechanism mounts on either side of the machine column for right- or left-hand assembly. The versatile self-contained driving head is ideal for use in automatic assembly machines incorporating dials and straight-line transfers.

The Model U drives screws from #6 x 3/16" long to 1/4" x 11/2" long . . . and can be equipped with 12" or 16" barrel feeders.



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15,334

MARVEI SYNCLINAL FILTERS

FOR DEPENDABLE PROTECTION on all Hydraulic and other low pressure circulating systems

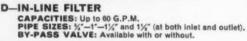
Designed to give more ACTIVE filtering area—MORE dependable protection—MORE productive operation before cleaning is necessary. Meet J.I.C. Standards.



A-Synclinal SUMP TYPE CAPACITIES: 5-8-10-20-30-50-75 and 100 G.P.M. PIPE SIZES: ½'-1'-1½'-1½'-2'-2½' and 3'. CONNECTIONS: Coupling—Male Nipple. BY-PASS VALVE: Not available.

Synclinal LINE TYPE CAPACITIES: 5-8-10-20-30-50-75 and 100 G.P.M. PIPE SIZES: ½"-1'-1½"-1½"-2"-2½" and 3". BY-PASS VALVE: Not available. OPERATING PRESSURES: Up to 80 p.s.i.

CAPACITIES: 10-20-30-50 and 75 G.P.M. PIPE SIZES: 1"-1½"-1½"-2" and 2½". BY-PASS VALVE: Available with or without. OPERATING PRESSURE: Up to 250 p.s.l. OPERATING TEMPERATURES up to 300° F.



E-Bonded SUMP TYPE CAPACITIES: 10-20-30-50 and 75 G.P.M.
PIPE SIZES: 1"-1%"-1%"-2" and 2%".
CONNECTIONS: Coupling—"0" Ring—Male Nipple.
BY-PASS VALVE: Available with or without.

Tandem SUMP TYPE CAPACITIES: 10-16-20-40-60-100-150 and 200 G.P.M. PIPE SIZES: 3'-1'-1'/-1'/-1'/-1'/-1'-2'-2'/2' and 3''. CONNECTIONS: Coupling-Male Nipple. By-PASS VALVE: Not available.









FILTERING MEDIA in all Marvel Filters is Monel wire cloth available in mesh sizes of 30-40-50-60-80-100-150 and 200 to meet your filtration requirement. EASY TO CLEAN-All Marvel Filters are easy to clean. Line type units operate in any position and may be serviced without disturbing pipe connections. OVER 900 O. E. M's. install Marvel Filters as Standard Equipment.

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- water	☐ Sump Type	☐ Line Type	☐ In-Line
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Company			
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City		State	-

Canada

PUNCH PRODUCTS CORPORATION, Buffalo, N. Y., announces an exclusive agreement with WM. F. BEAT-TIE ASSOCIATES, 191 King William St., Hamilton, Ontario, to manufacture and sell the entire line of Unipunch hole-punching and notching equipment in Canada.

India

BULLARD Co., Bridgeport, Conn., has licensed Kirloskar Bros., Ltd., with home offices in South Satara, India, to build Bullard vertical turret lathes and horizontal boring machines. In addition, they have been appointed sales agent to sell Bullard machine tools in that area.

Coming Events

JANUARY 9-13-SAE International Congress and Exposition of Automotive Engineering, to be held in Cobo Hall, Detroit, Mich. For further information, contact R. W. Crory, Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

JANUARY 23-26-Plant Maintenance and Engineering Show, to be held at International Amphitheatre and Palmer House, Chicago, Ill. For more details, inquire of Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MARCH 20-24-Twelfth Western Metal Exposition and Congress, sponsored by the American Society for Metals, to be held in Pan-Pacific Auditorium, Los Angeles, Calif. For more details, contact T. C. DuMond, ASM manager of Metal Congresses, American Society for Metals, Metals Park (Novelty), Ohio.

APRIL 18-20-Annual Welding Exposition, sponsored by the American Welding Society, to be held at the New York Coliseum. Concurrently (April 17-21), the society will hold a technical meeting at the Commodore Hotel, New York City. For more details: AWS Information Center, American Welding Society, 33 W. 39 St., New York 18, N. Y.

May 22-25-Design Engineering Show, to be held in Cobo Hall, Detroit, Mich. For further detail, inquire of Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MAY 22-26-ASTME Tool Show, to be held in New York Coliseum. For additional information, contact

Leonard Abrams, American Society of Tool and Mfg. Engineers, 10700 Puritan Ave., Detroit 38, Mich.

Film on Industrial Gases and Shielded-Arc Welding

Industrial gases and shielded-arc welding are subjects covered in a 16millimeter color film issued by the Air Reduction Sales Co., New York City. This film features recently developed welding equipment and techniques. It correlates the story of industrial gases-oxygen, nitrogen, hydrogen, argon, and carbon dioxide -with welding applications. An outline of the important role played by these gases, from their use in steelmaking to adding color to Times Square, is given briefly in the opening scenes. Prints of the film may be obtained on loan and without charge.

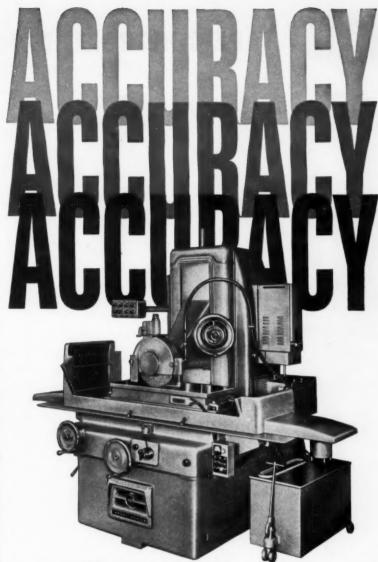


Frederick Van Norman

Machine Tool Pioneer Nears Century Mark

Frederick Van Norman, one of the founders of the Van Norman Machine Co., Springfield, Mass., celebrated his ninety-eighth birthday on December 13. Born in Hamilton, Ontario, Canada, in 1862, "Mr. Fred" moved to Waltham, Mass., when he was nineteen years old. There, with his brothers Edmund and Charles, he founded the then Waltham Watch Tool Co., forerunner of the present company. Relocating in Springfield four years later, the company became Van Norman Machine Tool Co.

Mr. Van Norman served as chairman of the board until his formal retirement in 1955. He is a frequent plant visitor, and he maintains a continued interest in the firm he helped develop over seventy-six years ago.



... to millionths of an inch

Accuracy that's a must for tool rooms ... so fine it can be measured only by a light bounce, so precise it produces microinch finishes at production speeds. This is the accuracy you get in the No. 560 Grand Rapids Precision Tool Room Type Hydraulic Feed Surface Grinder . . . accuracy assured by such features as hand-scraped V-shaped ways, rigid one-piece column and base casting, truly automatic cross feed and extra-heavy spindle. Why settle for less?

For information on the No. 560 or the Nos. 550, 360 and 350 Tool Room Type Surface Grinders, send a note on your letterhead.



GALLMEYER & LIVINGSTON CO.

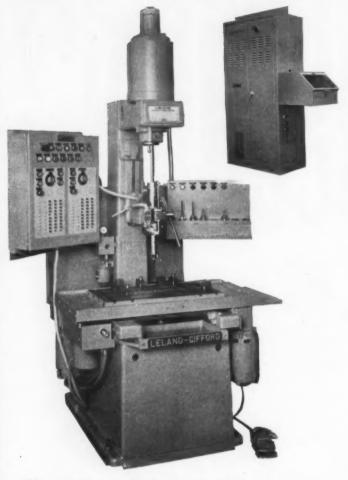
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Grand Rapids, Michigan



TAPE CONTROLLED HOLE LOCATOR

For General Purpose or Production Drilling



This sensibly simplified, sophisticated layout drilling machine combines the best features of the proven Leland-Gifford HOLE LOCATOR and the universally accepted G. E. Mark II numerical positioning control.

For single part operation, simply punch the keyboard or dial coordinates on the console. For repetitive work, use standard eight channel punched tape. Program can include automatic reversal for tapping and instant stops for tool and speed changes as indicated by flash tool change lights.

Rugged table has precision machined locating blocks, tee slots and locating keyways which extend the work capacity beyond the table traverse.

Write for detailed information and proposal or ask to have an experienced sales engineer call.

FEATURES

- Uses standard eight channel punched tape for production drilling.
- Single part operation by keyboard or dialing coordinates on console.
- Table traversed hydraulically on ball-bearing mounted and guided round ways.
- High speed positioning by self-contained, closed loop, hydraulic circuits and reversible
 G. E. Thy-Mo-Trol controlled motor driven pump.
- Highly accurate, sensitive precision ball-bearing spindle incorporates a zero float, quick change chuck.
- Six station turret depth stop plus 5" traverse hand feed.
- Eight spindle speeds of 150/225/300/450/-600/900/1200/1800 or 150/300/450/-600/900/1200/1800/3600 RPM, using reversing motor and back gears.
- Nation-wide control service available from General Electric Co.

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*Subject to change. Dimensions are approximate.

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Just Just If YOU Bend or Cut \$3.00 think of how fast you could get \$3.00 back. That's what the 196 page (156 illustrations and charts) "A Manual of Processes for The Cold Bending of Metals and Abrasive

Cut-Machining of Metals" costs. WALLACE SUPPLIES MFG. CO.

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For more data circle Item 231B

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PRECISION GEARS UP TO 200 DIAMETRAL PITCH
All Gears certified for Accuracy
Quality and Fine Workmanship

NEW JERSEY GEAR & MFG. CO.

-ALL MAKES . . .

Hillside, N. J.



put the small jobs on a lodge & Shipley

SPEED

"Match the job to the equipment"... a simple rule for doing it faster and at lower cost... means you also free heavy duty shears for the jobs they do so well!

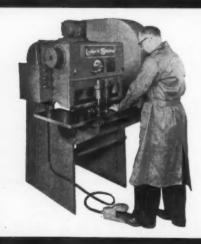
Particularly designed for fast cutting of small pieces, up to $\frac{1}{8}$ " x 24" mild steel, the Lodge & Shipley 24" Speed Shear is production proved for . . .

- Straight and Angle Shearing
- Sequence Shearing
- Slitting
- Blanking
- Notching

• Duplicating Straight Side Parts without Dies The Speed Shear is 'loaded' with features which speed and simplify set-up and operation. For time and money-saving details, please request Bulletin SS-1: The Lodge & Shipley Co., 305' Colerain Ave., Cincinnati 25, Ohio







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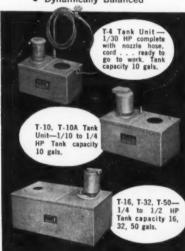
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- **Precision Built**
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- Dynamically Balanced





Tank Selection Bulletin 61A, including capacities, motor characteristics, etc. Write today or call MAin 1-5462.



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For more data circle Item 233A

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AIR TOOLS, PORTABLE Chicago Pneumatic Tool Co. . Cleco div. Reed Roller Bit Co.

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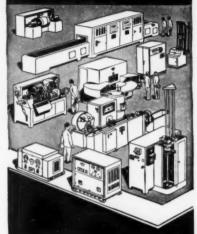
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Subsidiary of Hathaway Instruments, Inc. For more data circle Item 233B

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· Capacity of Coordinate table 6"x6"

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Setting of rotary table in 10 seconds

Spindle head tilts for oblique holes up to 15° from vertical



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KEM HI-SPOT BLUE No. 107 its used to locate high spots hen scraping bearing surfaces. As it does not dry, remains in condition on work indefinitely, saving scraper's time Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

YKEM CO., 2303R NORTH 11TH ST., ST. LOUIS 6, MO For more data circle Item 234D



For more data circle Item 234E

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the asking.

PIPE AND **TUBE MILLS** (ferrous or non-ferrous)

For more data circle Item 235A MACHINERY, January, 1961

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Zagar, Inc.



TYPICAL INDUCTION **HEATING APPLICATIONS**

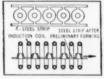
PLASTIC COATING





A production line operation for coating handles of tools at Whitney Metal Tool Co., Rockford, Ill. uses induction heating with excellent re-sults. The handles only are heated by induction to the desired temperature then dipped into a vinyl chloride base coating material for a short period depending upon the thickness of coating desired. The plastic coating formed on the handles is then cured by immersion in a carbo-wax bath.

FORMING OF METAL STRIP **FACILITATED BY** PROGRESSIVE ANNEALING



Metal forming operations which require intermediate anneals to restore ductility can be facilitated by induction annealing the strip pro-gressively. Diagram illustrates this procedure for partially formed thin austenitic stainless steel strip. The induction annealing operation is scheduled in the production line between two press operations. Metal strip and wire of other materials are also induction annealed

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For more data circle Item 235B

Classified Section

astern Rebuilt Machine Tools THE SIGN OF QUALITY THE MARK OF DEPENDABILITY

The listing below is only a VERY SMALL AMOUNT of the total number of machine tools that we have in stock for immediate shipment. Our prices are realistic with today's market and our quality of rebuilding is the same high standard—THE LEADER IN THE FIELD OF REBUILT MACHINE TOOLS.

AUTOMATICS

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Victor Nut Facing Machine, m.d. cap %" to 2" nuts 1½" Landis 2 spindle, m.d. 1½" Landis Bolt Threading Machine, double head stay bolt, m.d.

No. 44 Heald Facing Type Borematic, m.d. Model DB-102 Excello Double End Boring Machine, m.d. No. 47A Heald Single End Borematic No. 49 Heald Double End Borematic, m.d.

HORIZONTAL RORING MILLS

HORIZONTAL BORING MILLS
3\fomular bar incinents dilbert Horizontal, Boring, Drilling
\$\frac{\pi}{2}\$ milling, floor type
3\fomular bar Cincinnats dilbert, table type
3\fomular bar, No. 32 Giddags & Lewis Table Type, m.d.
4\fomular bar, Model 72, Niles-Bement-Pond, m.d.
Morton Horizontal Boring Mill and Draw Cut Shaper, floor

VERTICAL RORING MILLS

KERICAL BORING MILLS

6" Sullard Mult-Au-Matic, m.d.

4" Sullard Spiral Drive, m.d., 1944

6" Sullard Spiral Drive, m.d., 1944

6" Sullard, M.d., late 1944, Spiral Drive

2" Sullard, Solrial Drive, m.d.

2" King, m.d.

4" Putnam, m.d., p.r.t.,

3" Niles Heavy Pattern, m.d., p.r.t., late

4" Cincinnatt H.D. Hypro, m.d., p.r.t., late

4" Cincinnatt H.D. Hypro, m.d., p.r.t., late

4" Cincinnatt H.D. Hypro, m.d., p.r.t., late

60" Niles Vertical, m.d., 96" diameter table

forth & Merryweather Vertical Auto. Turning & Form
ROACHINES MACHINES

BROACHING MACHINES

Model HD 10-90 American Broach & Machine Co., Horita, m.d. 10 ton, 84° stroke LaPointe Single Ram Vertical Surface Broach, m.d., late Type SBD-42-6 American Vertical Hy. Dup. Broach Type SBD-4315 American Vertical Dup. Ram Surface Hydraulic Broach

RADIAL DRILLS

Cincinnati-Rickford, 9" ('Inelinati-Rickford, m.d. super service -10" col. American Triple Purpose, m.d. -11" col. American Hole Wizard, m.d. -13" col. American Hole Wizard -13" col. Cincinnati bickford, Super Service, m.d. -13" col. American Hole Wizard, m.d. -17" col. American Triple Purpose, m.d.

6' -17" col. American Hole Wizard, m.d. 6' -19" col. Carlton, m.d.—1943 7' -16" col. American Triple Purpose, m.d. 8' -19" Fosdiek, m.d. Baush Radial Drilling & Tapping Machine, m.d. SALL BEARING DRILLS

SALL BERKHING DHILLS
No. 1/2 Avey MAS, m d.
No. 2LMS Leland & Gifford, m.d., H.S.
No. 2 LMS Leland & Gifford, single spindle, m.d., H.S.
No. 4 BM Fosdick, single spindle H.S., m.d.
No. 4 MS Leland & Gifford, H.S., d. 4 speed A.C., m.d.

No. 4 BM Foodick, single spindle H.S., m.d.
No. 4 BM Foodick, single spindle H.S., m.d.
Veo spindle
Spindle No. 2MA6 H.S. Type B, m.d., Avey, 7 ½"
overhang, 1943
2 spindle No. 2 BMA H.S. Type B, m.d., Avey, 7 ½"
overhang, 1943
2 spindle No. 2 EMA I Avey Production Type, m.d.
2 spindle No. 2 EMA I Avey Production Type, m.d.
2 spindle No. 2 BMA I R.S., m.d.
2 spindle No. 2 LEMA L.S., m.d.
3 spindle No. 2 LEMA L.S., m.d.
2 spindle No. 2 LEMA L.S., m.d.
2 spindle No. 2 LEMA L.S., m.d.
3 spindle No. 2 LAMS Leland & Gifford H.S., M.d.
3 spindle No. 2 LAMS Leland & Gifford, hydraulic rtep
by Step H.S., m.d.
3 spindle No. 2 BMA 6 Avey, H.S., m.d.
3 spindle No. 2 BMA 6 Avey, H.S., m.d.
4 spindle Leland-Gifford JS. LMS—H.S., m.d.
4 spindle Leland-Gifford, m.d. on each spindle
4 spindle No. 15 Buffalo Bench Type
4 spindle No. 15 Buffalo Bench Type
4 spindle No. 15 Buffalo Bench Type
4 spindle Demeo H.S., Individual. m.d.
4 spindle No. 2 BMA 6 Avey H.S., m.d.
4 spindle No. 2 BMA 6 Avey H.S., m.d.
5 spindle Allen H.S., belt drive
5 spindle Allen H.S., belt drive
5 spindle Allen H.S., belt drive
6 spindle Allen H.S., belt drive
6 spindle No. 1 Avey Hugh Speed, m.d.

6 spindle Leianu-Ginesa.

Taper
6 spindle No. 1 Avey High Speed, m.d.
6 spindle No. ½ Avey MA3, m.d., H.S.

HORIZONTAL DRILLS

2 mindle No. 410 W. F. & John Barnes, m.d.
No. 410 W. F. & John Barnes, m.d.
No. 410 W. F. & John Barnes, horizontal boring & Drilling Machine. m.d.
No. 10 Barnes Single Spindle Deep Hole, m.d.
No. 2 Aver Stype MA 1, with horizontal operation
No. 1/2B150" Pratt & Whitney Gim Barrel Rifling.
Model M1821, m.d. lates
No. 1½610" Pratt & Whitney 2 mindle deep hole drill
No. 1½7105" Pratt & Whitney, 2 mindle Hydraulic
Deep Hole Drill, model 973, m.d., latest
No. 1½72105" Pratt & Whitney, model M1825, 2 spindle Ge Gim Barrel Rifling, m.d.
3%" Baush Double Horizontal Drilling machine, m.d.
No. 420 Barnes 2 spindle Deep Hole Drill and Boring
Machine

No. 220 Bärnes z spindus beep rede scheden. Machine
No. 445 W. F. & John Barnes Independent 2 spindle
Deep Hole Drill & boring machine. Lake
No. 221 Natco Horizontal Boring & Drilling Machine
No. 221 Natco Horizontal Brill. 2 opposed BaEP head, 1943
No. 2 LeBlond Deep Hole Borer, m.d., 1943

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Shown here is a #3 KM Kearney and Trecker vertical milling machine which was re-built to new machine tolerances. In addition, it was adapted for milling locating pads on diesel engine crankshafts. This is a good example of Miles' ability to equip its re-built machines to perform specific machining operations.



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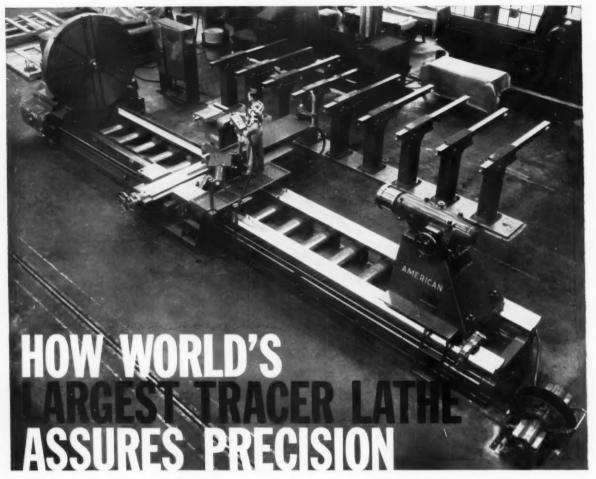




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